



Third degree burn of abdomen and chest

See page 19

INTERNATIONAL CLINICS

A QUARTERLY

OF

ILLUSTRATED CLINICAL LECTURES AND
ESPECIALLY PREPARED ORIGINAL ARTICLES

ON

TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PÆDIAT-
RICS, OBSTETRICS, GYNÆCOLOGY, ORTHOPÆDICS,
PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY,
OTOLOGY, RHINOLOGY, LARYNGOLOGY,
HYGIENE, AND OTHER TOPICS OF INTEREST
TO STUDENTS AND PRACTITIONERS

BY LEADING MEMBERS OF THE MEDICAL PROFESSION
THROUGHOUT THE WORLD

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VOLUME IV. THIRTY-EIGHTH SERIES, 1928

PHILADELPHIA AND LONDON

J B LIPPINCOTT COMPANY

1928

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PRINTED IN THE UNITED STATES OF AMERICA

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a well-defined clinical entity, which also passes under the name of *osteochondritis of the hip*, or *coxa plana*

But that is not all

You are certainly familiar with a very common deformity, *congenital dislocation of the hip*, which is characterized by the fact that the head of the femur does not lie centrally in the acetabulum, but is slipped out of it. This displacement is not always of the same degree. Sometimes it is so complete that the femoral head has no connection with the acetabulum, and this is the true *congenital dislocation*; at other times the head is but slightly displaced upward, leaving a small portion of the cavity vacant, and this is what is usually called *congenital subluxation of the hip*, a condition actually very common, and to which no great importance was attached, because it was supposed that it did not interfere in any way with the function of the joint.

It is true that in infancy the subluxation does not cause any functional disturbance. Children so affected walk so well that only a trained eye can detect a little limping. But when these patients reach adolescence, or adult life, then bit by bit, the joint becomes painful, rigid, contracted and a limping gait develops. With advancing age the disturbance of function increases and forms a clinical picture identical with that of arthritis deformans. The X-ray appearances are also very similar, apart from the fact that the enlarged, deformed femoral head, instead of lying within the acetabulum, is more or less separated from it. Experience has shown in the last few years that this subluxation is far more common than was thought and that it plays a notable part in the pathogenesis of arthritis deformans. It has been contended that infantile arthritis deformans, that is the disease of Legg-Perthes-Calvé, has its origin also in a congenital defect of the joint. Calot, the well-known French orthopaedic surgeon, is a confirmed supporter of this idea.

Such is a brief summary of the facts which have served to modify our conception of the pathogenesis of *malum coxae senile*. The same causes which may induce arthritis deformans in advanced age can produce analogous conditions in the years which precede senility. *Malum coxae senile* often has its origin in conditions which arose long before it manifested itself clinically, and sometimes these conditions are congenital.

These conclusions which one arrives at by studying the natural

lowed by erosion of the subjacent bone. Simultaneously appear phenomena of a hypertrophic reaction in the margins of the head and of the acetabulum, with the formation of exostoses and osteophytes. As the result of these changes in the structure of the tissues, the femoral head widens and the acetabular cavity becomes shallower, the joint interval is reduced and the secretion of synovial fluid diminishes. As a result of the flattening of the acetabulum and of the enlargement of the femoral head, the latter tends to slip upward and dislocate, an event which occurs the more readily in cases in which the arthritis develops in a hip with congenital subluxation.

Side by side with this hypertrophic form of arthritis deformans exists, although rarer, an *atrophic type*, which is almost always of infective origin and in which destructive phenomena predominate over hypertrophic ones.

The pathology of arthritis explains its *symptoms and course*. The first symptom is pain, which is followed by rigidity. This latter progresses slowly. The movements which are first diminished are those of rotation, after them those of abduction. Movements of flexion and extension are retained for a long time. The stiffness is accompanied by defensive contractures, which slowly compel the limb to adopt a fixed attitude of flexion, adduction and external rotation. As a result of this there occurs an apparent shortening, which may become actual also, if the femoral head slips out of the acetabulum. In more advanced cases the movements of the joint are almost completely abolished, but a true, solid bony ankylosis only rarely occurs.

The *progress* of the disease is almost always very slow. From the onset of the first symptoms it takes many years for the rigidity and deformity to become so fixed as to render weight-bearing almost impossible and the gait very crippled. One may say in a general way that the course of arthritis is dependent upon the strain to which the joint is subjected.

I wanted to give you these few remarks on the pathology and symptoms of arthritis deformans in order that you may understand better what I am about to say concerning the *principles of treatment*.

We must confess right away that a radical cure of arthritis does not exist. The structural changes which it induces, once developed, cannot be modified. But that does not justify the pessimistic atti-

tude which prevails in regard to the treatment of osteo-arthritis, an attitude which must be opposed, for it deprives the surgeon of his best chance of early intervention at a time when it is still possible to get the best results. In favorable cases, treatment is able to overcome the pain, eliminate the causes of aggravation, arrest the disease in its first stages, and thus produce results, which functionally are almost equivalent to a radical cure. In advanced cases treatment is successful in proportion to its capacity to overcome the contractures, correct the deformity and provide better conditions for weight-bearing. It is therefore important that the practitioner should realize that arthritis deformans is not an incurable disease, and that he should above all remember that treatment has the greatest probability of success when it is begun early.

All rational treatment must be directed to combatting the cause of the disease. As we have seen, the causes of arthritis deformans are multiple, but the commonest are infection and traumatic irritation of the joint. It is to these causes that we must direct our activity in the majority of cases. But often, being unable to attack the cause, or being unable to ascertain it accurately, we shall be obliged to turn our attention only to the effects, and then our treatment will be symptomatic.

As we have said, the infections which are most often responsible for osteo-arthritis seem to be the *focal infections*, that is, those derived from infective foci, which exist in other parts of the body and from which issue germs or toxins that are able to affect the joints. A careful and complete examination of the patient is therefore necessary in order to discover such possible foci of toxic absorption, which may be situated in the alimentary, respiratory or secretory systems or in the urinary tract.

You know well how much importance has been attributed to dental infection and pyorrhœa alveolaris as the causal agents of arthritic phenomena. Sir Arbuthnot Lane and his school have maintained that intestinal stasis plays a large part in the pathogenesis of these phenomena. It is therefore necessary to examine carefully the alimentary system, to eliminate whenever possible infective foci, to advise strict hygiene of the mouth, and to suggest a diet likely to eliminate the causes of stasis and intestinal putrefaction. The choice of suitable nourishment is also of importance in order to avoid the

adiposity, to which patients with osteo-arthritis of the lower limbs are subject, from the restriction of their physical exercise. Increase of weight, by increasing the strain and friction of the joints, contributes to impair function. Often, too often, the struggle against adiposity fails, because these patients do not put on weight on account of over-feeding and lack of exercise, but because their metabolism is organically altered. On the other hand, limitation of diet beyond a certain degree impairs the powers of resistance of these patients, who are almost always weakened by long suffering and by affections of the cardio-vascular and renal systems, which nearly always accompany this disease. In an old man one must pay attention to the urinary system and seek to eliminate infections which may come from the bladder, urethra, or prostate. In a woman it is the genital system which is frequently the seat of infective foci.

The means at our disposal for combatting the local effects of arthritis are few and indirect in their action. Amongst drugs, salicylic acid and its derivatives, which have a recognized specific action on the syndrome of generalized arthritis, have but slight efficacy for monoarticular arthritis, in which the most they do is to diminish the pain. Atophan (a phenol-chinolin-carbonic acid) and its derivative atophanyl, which are definite chemical substances, found to exercise a powerful influence upon the uric acid metabolism, have a slight temporary action on the disturbances of osteo-arthritis.

Amongst physical measures we must recognize the great importance of those which induce active hyperæmia. The mechanism by which hyperæmia acts is a very complex one and not completely understood. Vaso-dilatation, by producing activation of the interchanges of the body fluids, increases the power of defence, contributes to the neutralization of toxins, stimulates the processes of repair and, by an inhibitory action on the nerve endings, reduces the pain.

As you know well, the efficacious means for producing active hyperæmia is radiant heat, which is obtained from special electric apparatus or from a spirit lamp. Nowadays diathermy is much used, in which high-frequency currents are utilized to get the action of heat in the interior of tissues and organs. I have had much experience with the hyperæmia treatment, and I may say that among the many methods proposed and in use for producing hyperæmia, the one which gives the best results in the treatment of arthritis is the so-

called Bier box, which consists of a wooden case, containing a current of hot air, produced by a spirit lamp

I cannot discuss at length the technic of active hyperæmia, but I must declare that no other form of physio-therapy acts more effectively than it in the treatment of infective or traumatic mono-articular arthritis. Under the action of intense heat the pain diminishes, contractures are relaxed and the joint becomes more mobile. Of course, we cannot expect from hyperæmia a radical cure, but used in conjunction with the treatment of which we are about to speak, it constitutes a precious therapeutic weapon, both in the early and in the late stages.

Amongst other methods of physio-therapy may be mentioned massage, hot baths and passive movements. These latter, if carried out with good technic, may in early cases succeed in overcoming the stiffness and contractures and in stimulating reparative processes.

No treatment will succeed in this arthritis unless it aims at removing the mechanical irritation produced by movement, in other words, unless it puts into use means for securing more or less complete rest of the joint. Whatever the cause of the arthritis, if one wishes to prevent aggravation of the local condition, one must exclude the irritative stimuli which friction and movement exert on the joint surfaces. Therefore the first advice to give to a patient with arthritis deformans is to restrict as much as possible the use of the erect position and also walking. If the patient is still young, it is desirable to convince him of the necessity of diverting his activity to a sedentary occupation, if the patient is of advanced age, it is well to advise him to give up any exercise which tires the hip-joint. Use of traction during the night is very helpful. The reduction of pressure and friction and the relative immobilization which traction procures serve to soothe the pain and diminish the contracture.

Immobilization produces a double effect: it eliminates the mechanical irritation and thus overcomes contracture and stiffness, or by abolishing all movement it produces ankylosis. One can attain the one or other of these effects according to the method by which immobilization is procured and the time during which it is continued.

Plaster apparatus is the most effective. A long plaster spica for cases which need rigorous immobilization, a short spica in less serious

cases With a plaster apparatus the patient can walk. It is impossible to lay down rules for the length of time that the apparatus must be worn That depends on what we are attempting, on the severity of the arthritis, on the temperament of the patient To overcome an acute irritation sometimes a few weeks suffice, to obtain ankylosis (which will never be complete bony ankylosis) the duration of immobilization must be much longer I have a decided predilection for plaster apparatus, as the one which gives the best immobilization, is cheap, and can be easily renewed If it is split into halves it can be removed for physical treatment and during the night But patients of certain age tolerate badly plaster apparatus One can then use as a substitute a celluloid splint or a moulded-leather support These forms of apparatus also serve to take weight off the limb, if we prolong them beyond the foot. A well-made apparatus, comfortable, light and well fitted, which keeps the joint in good position, may give real relief and allow correct walking

The question of the position of the joint is very important I have already said that the contractures gradually bring the limb into adduction, flexion, external rotation It is this adduction deformity that gives the difficulty with the erect position and walking, and to which is also due the gradual dislocation of the femoral head, which renders the limb practically useless To avoid or correct this deformity is thus one of the most important objects of treatment

The means used to avoid contractures are the same as those for overcoming rigidity, that is rest, radiant heat, massage, traction, passive movements, and immobilization When the deformity is firmly fixed one must use other methods If the arthritis is not of long standing and the fibrous degeneration of the capsule is not far advanced, one may resort to manipulations under anaesthesia and to subcutaneous tenotomy of the adductors The manipulations must be carried out with much care, gently and progressively, in order to avoid fracture or crumbling of the bones A very serious danger, fortunately infrequent, is fat-embolism, to avoid which one must try not to cause crushing, or hæmorrhage Correction of the deformity must be maintained by a long *plaster spica*, which must be left on for not less than a month, and must then be replaced by a *celluloid* or *leather splint*

This method of correction of the deformity can be carried out

at all ages and its results are generally very satisfactory. But as we have said, forcible correction of the deformity cannot be carried out in every case. If the deformity is an old one, if a very resistant ankylosis has formed, or if a dislocation has occurred, it is only possible to obtain correction by an open operation, known as *subtrochanteric osteotomy*. No words are adequate to express the benefits to be derived from this operation when properly performed.

It is really astonishing that Page, who devoted to the treatment of osteo-arthritis a very important article in the *British Journal of Surgery* a few years ago, should not have given it the slightest consideration. Subtrochanteric osteotomy is in a position to offer considerable and lasting benefit with the simplest means, rapidly and with small risk. The osteotomy may be transverse or oblique. This latter we use especially in the cases in which the femoral head is subluxated or dislocated. One thus insures that the distal fragment shall rest on or enter the acetabulum or its neighborhood and give greater stability. This osteotomy goes today by the name of Lorenz's bifurcation. An osteotomy will correct any degree of deformity. It could be carried out with local anæsthesia, but it is preferable to use ether to obtain a more complete correction and to have time for applying the plaster. The long plaster spica is left on for about two months. *Walking and weight-bearing are not only permissible, but desirable*, to induce a more rapid formation of callus and to accustom the patient quickly to the *new position* of the limb. *After two months the long spica is replaced by a short one*, which is left on for another two months, after which free use of the limb is permitted. Subtrochanteric osteotomy has the great advantage that it can be carried out in patients of any age. Thanks to it, one can restore good and painless walking in patients who for many years have been unable to use the limb.

But osteotomy is not the only surgical method of treatment of osteo-arthritis. There are more radical operations designed to secure an ankylosis, or to produce a fibrous false-joint, or to create a new joint.

Among the anchylosing operations first place must be given to excision of the joint. The principal aims of excision are to stop pain, to correct the deformity and to insure firm union between the femur and pelvis, that is, an arthrodesis. Experience shows that in

practice excision does not give good results. Bony ankylosis is rarely attained. Thus there forms a pseudo-arthritis, which is almost always painful, unstable and one which easily allows relapse into adduction deformity. Furthermore, the operation must be regarded as a dangerous one, and it demands prolonged immobilization. For these reasons it is generally contra-indicated in subjects of advanced age. Albee has tried to facilitate the ankylosis by a plastic excision to which he adds an autogenous bone-graft.

Amongst the operations designed to produce a fibrous false-joint there is simple excision of the head of the femur, an old proceeding which was much in favor for a time, but now has been abandoned in view of the bad functional results which it produces. Much more rational is *Whitman's reconstruction operation*, a procedure used chiefly for the treatment of pseudo-arthritis of the femoral neck, but which finds its place also in that of osteo-arthritis. As you know, Whitman's operation consists in excision of the head of the femur and the introduction of the femoral neck into the acetabulum after separation of the great trochanter with its muscular insertions. Thus the neck takes the place of the head of the femur in the cavity and the trochanter, inserted lower than its normal position, allows the pelvi-trochanteric muscles to continue to carry out their function. I have used Whitman's operation repeatedly and with good results in the treatment of pseudo-arthritis of the femoral neck, but I have not yet tried it for arthritis deformans. All the same, I am convinced that in suitable cases it would be most useful, but like arthroplasty, of which I shall speak next, it is an operation which produces considerable shock, and therefore is not very suitable for old patients.

Arthroplasty, theoretically considered, is the ideal operation for the radical treatment of osteo-arthritis. No other procedure can better remove the causes of the symptoms which osteo-arthritis provokes than an operation designed to give a complete reconstruction of the joint.

Many criticisms have been levelled against it, but the only consistent one is that it is not an operation suitable for old age. Arthroplasty of the hip is a long operation and may produce great shock, and it demands long and tedious after-care. Thus it is an operation for individuals who possess a high degree of organic resistance. For these reasons I have never carried it out in individuals of advanced

age but I have repeatedly tried it in patients between thirty and forty years. I may say that the results I have obtained have been truly encouraging. I think the principal objection brought against arthroplasty in the treatment of arthritis deformans, that it cannot arrest the course of the disease, because it does not touch the cause, is unfounded. I have cases operated on several years ago, whose radiograms show clearly that the shape given to the femoral head and to the acetabulum has kept unchanged. On the other hand, the new joint is painless, stable, resistant, and I have never known the adduction deformity to recur. The range of movement is not usually very conspicuous, but this is not the thing of most importance in cases like these, in which the chief aim is to obtain a firm, painless joint.

I have dealt thus rapidly with the methods of treatment of arthritis deformans, and have tried to present more particularly those among them which are applicable to the treatment of individuals of advanced age.

There is no doubt that the unfavorable conditions resulting from senility render this treatment a most difficult problem, but with a suitable choice of the best weapons which therapeutics offers us it is possible to eliminate, even in old people, the greater number of the inconveniences which arthritis deformans produces.

CONCERNING CERTAIN PHASES OF ANGINA PECTORIS

CHIEFLY BASED ON A STUDY OF 320 CASES

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I SHALL not attempt fully to discuss angina pectoris in this paper. I cannot even attempt to consider all its most important aspects, for it is quite impossible for me to give an adequate discussion of this increasingly important syndrome in one article, and I have therefore chosen rather to present to you for thought and consideration only certain phases of the problem which have particularly intrigued me in my study of these cases in my hospital and consulting practice during the past five years.

Nor shall I undertake a review of the historically rich and interesting literature on the subject, much as might be learned from it, for I feel that the work of the past few years has given us all a new and much broader comprehension of this subject as well as of circulatory disease in general. Also I take it that most of you are already familiar with the literature of angina pectoris, at least those of you who are at the present time engaged in general practice, or in internal medicine.

No attempt is made to discuss the subject in a conclusive manner. Much if not most of our opinion in regard to this fascinating condition is now undergoing a very rapid evolution. I am also very far from believing that my present conception in regard to any aspect of the problem is final or satisfactory. I know I have very much to learn of the subject from all of you, and I trust that all of us within the next few years unitedly arrive at a comprehension of the subject which will give us a far better mastery of the condition than we have at present. We know the subject to be most important, and increasingly so since the syndrome is undoubtedly rapidly increasing in occurrence and, directly or indirectly, it covers a very considerable part of the great problem of circulatory disease with which the medical profession is now so industriously concerned.

As I have already said, I shall not attempt to cover the whole subject, but only certain phases of it which have particularly interested me and puzzled me. My paper therefore is comprised mostly of personal observations and theories founded for the greater part on my more recent clinical and pathological experience with cases of the syndrome. Please do not, therefore, consider me egotistic in that I confine myself so largely to my own experience, for my object is rather to arouse discussion and comparison of opinion in your own minds so that you may take back with you a broader concept of the condition as a whole.

I think that it is obvious to all of us and that we must accept it as an axiom that angina pectoris is not a disease entity but rather a symptom complex caused by at least several different pathological states and that it is not a disease in any sense of the word, but merely a symptomatic picture. Yet this picture is so definite in its appearance and so characteristic and dramatic a clinical entity, so very important a problem in every respect, that we should not in my opinion attempt to displace the term by anything more definitely allied to a specific pathology.

The condition is always a serious one, one in which great disability and frequently death occur. Ordinarily both its onset and its termination are of such a tragic and almost theatric type that I am sure that most of us share with the intelligent laity in a most wholesome fear of it. A constant menace of sudden death should always be conceded with it, and often this termination is of such an unheralded character that both physician and layman are always seriously impressed with the diagnosis. We are none the less more and more coming to realize that many cases, even severe instances of the syndrome, may persist for years without causing either death or great disability. It seems to me also that our better understanding of the condition has led us to so treat it and to so manage our patients who are sufferers from it that they may in not infrequent instances occasionally live long, successful and useful lives even though subject to the condition. I feel that as we come to better understand not only the disease but also the individuals who suffer from it that we are now able to offer a much more cheerful prospect to the sufferer. If we sufficiently individualize treatment we are much more likely to give relief as well as a prolonged and not inconsiderable period of

worth-while life and efficiency. Most of us can now cite unmistakable instances in which complete relief, even "cure" if you like, has been effected.

I think that all of us will admit that the condition is now much more frequent than was the case in the not remote past. Twenty or thirty years ago the disease was relatively rare in the so-called hospital classes. I have an explanation to offer for this fact, one other than that we are now certainly much more generally competent in the diagnosis and recognition of the complex. A few years back it was considered almost as a disease of the intelligent aristocracy, and as particularly of great frequency among our own and other professions, a disease of the "intelligentsia," if I may so say it. This distinction, in my observation, no longer pertains. I am finding angina frequent in my wards at the City Hospital, which is a charity hospital and one which caters, I may say exclusively, to the most unfortunate classes of our people. In my analysis of these cases at the hospital I have found almost without exception the disease associated with worry and great stress of life. These features are no longer confined to the so-called brain worker. Every class of society is now living lives of great and increasing emotional stress. The obligatory demand presented to every person, physical or brain worker, is for more speed, greater production and greater stress in every relation.

The statistical data which I have utilized in the preparation of this paper have been taken exclusively from my private consulting practice. Of the series of three hundred and twenty cases studied, sixty-two persons, including most of the women, were engaged in domestic occupations. But eighteen were physical laborers, including policemen, soldiers, firemen and the like. Twenty-six cases were of the learned professions, fifteen were engaged in artistic callings, eight were financiers, three engineers. Fifty patients occupied executive positions, and seventy-nine were engaged in business ventures. This list suggests, of course, an increased occurrence among executives and business men. As in all lists of this kind, the decisive ratios are largely influenced by the preponderating character of the clientele which comes to any particular physician.

It is my impression that the complex is of growing occurrence among women, due perhaps to the increased stress of life to which

is so characteristic and almost invariably present during the attack quite independent of the knowledge of the patient, or even of his desire to live. In physicians, absolutely unafraid of death, entirely understanding the nature of the symptom and perhaps perfectly accustomed to it, it is just as terrorizing as to an ignorant or absolutely nonunderstanding person. This phase of the complex seems to be more closely associated with an emotional state, with a disturbance of the psyche rather than with merely a local vascular disturbance. I wish to particularly direct your attention to this special symptom, to me it is most interesting, and I think that it is the most characteristic and unfailing of all the symptomatology of the syndrome.

I must refer again to the condition of vascular spasm and especially to the effect on blood-pressure. I do not know why it is, but the profession at large seems to hold the impression that this complex is associated with a general hypertension. But eighty-seven of my cases showed hypertension and in at least thirty-seven of these instances the hypertension was not a result but a remote cause of the condition. On the contrary, during the actual attack the blood pressure is most commonly lower than the customary blood-pressure of the individual, nor is the symptom complex, in my experience, more frequent in instances of hypertension than in those who have low or ordinary pressure figures. In one hundred and six of my cases the pressure was held well within normal limits, in fifty the pressure was subnormal. As a rule in the attack, as in all other forms of shock, the general blood-pressure is depressed during the spasm. How it may be in the heart itself, or in the coronary vessels, I leave you to speculate. This is not to be considered as contraindicating the use of the vaso-dilators in the relief of the attack. I have never seen the nitrites do otherwise than give benefit in even hypotensive cases, though as you all know they are often inert in so far as stopping the attack is concerned.

Admittedly the most difficult matter in so far as diagnosis is concerned is the differentiation of true cases of angina from those conditions in which angina pectoris is closely simulated by phenomena which have in themselves no serious menace. Time-honored custom has grouped these conditions under the heading of pseudo-angina. I see no real reason why this term should not be preserved.

My distinction, and that which I find is commonly accepted by most active clinicians, is based on prognostic values almost entirely. It is recognized by all of us that the mildness of the attack is no proper measure or essential criterion, for in many of these instances the danger to life is quite as great as in those in which the suffering is prolonged and very severe. The distinction must then be based on the presence of anatomical lesions, and to a certain extent on etiology.

In pseudo-angina anatomical defects do not exist in the heart or aorta, whereas in true angina pectoris I hold that lesions exist to a recognizable degree in practically all instances. The time and the occasion do not permit me to enter more than superficially into this differentiation, but practically all cases of pseudo-angina may be grouped under the heading of psychic and emotional phenomena. They are tremendously frequent, particularly now that the laity has become so conversant with medical or pseudo-medical literature and because of the agitation which we ourselves have started for the purpose of acquainting the public with medical matters. For each true case of angina which I see, I am certain that at least two instances of false angina present themselves in my office. As a rule the differentiation is not difficult, for most of those who come with the spurious article are obviously neurotics. Many of them are so well educated in the symptomatology of the disease that their history is most misleading and difficult to evaluate until the physician becomes sufficiently acquainted with the patient to judge the credibility of his story by the character and traits of the would-be patient. Quite naturally, physicians, medical students and nurses comprise a large proportion of the cases of pseudo-angina. When the physician is permitted, however, to view his patient during one or two attacks few mistakes in differentiation will occur. The picture of angina pectoris is certainly one of the most characteristic in medicine. Combine such an observation with a diligent search for pathology and with a careful historical and physical study of etiology and the careful physician will make few mistakes. Unfortunately, however, neurotics may frequently present possible etiological factors worthy of full credence, and even anatomical lesions may be also present which justify the more serious diagnosis. Of course there is no reason whatever why the pseudo-case may not ultimately develop a true

complex, still when one can see the attack or secure a description of it from some credible witness, mistakes will not frequently occur, and rarely indeed when the case can be held under observation for a reasonable length of time

Toxic angina is another clinical picture which in my opinion should be carefully separated from true angina if we are to study the disease with any scientific satisfaction. In my experience there are just three toxæmias which produce a picture easily confused with true angina pectoris. They are those produced by the abuse of tobacco, coffee and tea. The first, that produced by the abuse of tobacco, or in some instances developed as a result of an abnormal sensitization to tobacco, is exceedingly frequent. In but four cases of true angina under my observation has tobacco been a possible causative factor, it is a common productive factor in toxic angina. This relation is becoming more and more important since women have so widely taken up the use of tobacco, for as a class I think we may definitely say that women are far more susceptible to the bad effects of tobacco than men. They are also for various reasons much more likely to carry the use of the weed beyond, far beyond, the mere employment designed to give pleasure and a feeling of contentment to the formation of a definite injurious habit. I am prepared, however, to admit with very few qualifications that the use of tobacco is undesirable in true angina pectoris, that it tends to augment the severity of bona fide attacks, to increase their frequency and greatly to increase the danger of the attacks. I know, however, of no authoritative study which has shown that tobacco can produce any changes in the heart muscle, in the coronary arteries or in the aorta, which are capable of causing a true angina. I have never seen a case of supposed tobacco angina die, except that there were found after death lesions quite typical of those which cause angina pectoris and which cannot be produced by tobacco alone. I have seen many instances of tobacco angina which were very distressing, I have seen patients so sensitized to the effects of tobacco that they might not enter a room in which smoking was going on without developing an attack, a clinical picture which is almost the exact counterpart of a true anginal attack, but I have never seen such a case die. Almost without exception prompt giving up of the drug in persons who have developed tobacco angina is followed

almost, if not quite, immediately by a cessation of the attacks I have seen no treatment in true angina which is so successful

Coffee angina is much more frequent in advertising literature than in medical reports. It is not often seen in the consulting room or the hospital, but it does exist. It, too, is promptly relieved by the elimination of the drug or by cessation of its abuse. Attacks rarely proceed beyond the point of a vague, rarely reflected discomfort or mild pain in the region of the heart. Coffee is quite incapable of causing in the heart lesions similar to those essential to the production of true angina pectoris. Most of us now employ in the treatment of angina drugs similar to or identical with the essential principles of coffee, theobromine, euphaine, and caffeine. My experience leads me to feel that in those instances in which angina appears from the abuse of or unusual sensitization to coffee, the attacks are brought about by the over-stimulation of the nervous system and therefore probably the mechanism is quite similar to that manifested in pseudo-angina pectoris. I am reasonably certain also that at least some of the cases are purely imaginary, perhaps stimulated by the advertising pages of our cheaper grade magazines.

I have never seen a case of angina caused by the abuse of tea. I believe, none the less, that they do occur, but probably in very small numbers, save in populations which consume tea in greater abundance than is customary in the localities in which I have practiced. English and Canadian colleagues have described cases to me.

In all the toxic anginas almost immediate relief follows the elimination of the causative drug. In so far as I can determine in none of the cases are any permanent lesions developed and the only treatment necessary is abstention from the drug. Sensitization to the drugs concerned in toxic angina may often persist for long periods of time and the sensitization may become as acute as in any form of proteid sensitization, so that infinitesimal quantities of the specific drug may suffice to precipitate the paroxysm. In so far as I can learn there are no cases of toxic angina on record in which electrocardiographic evidence of coronary spasm or embolism has been shown. Of course any of these drugs used to excess may produce electrocardiographic changes, but not those typical of an angina pectoris of the coronary type.

In my opinion one of the very most important phases of the

subject of angina pectoris is the study of the question of pathology and incidentally that of etiology. The two are indissolubly blended. It has been this phase of the question which has much interested and engaged me during the past few years, and I believe that it is the study of this portion of our problem which should lead directly to a better understanding and command of the therapeutics of the disease.

Most authors mention in this connection that there are cases of angina, even fatal ones, in which absolutely no pathology of the circulatory tract can be demonstrated. So many excellent authors mention this fact that I think that we must accept it, but always the question remains in my mind of how carefully the tissues of the heart muscle and of the coronary vessels in particular were studied. I can recall but one of my anginal autopsies in which I was unable to find what I considered adequate lesions in the heart or aorta. In this instance, however, no microscopic studies were made, and therefore there could be no knowledge of the numerous microscopic alterations in the muscle which might exist without gross recognition and which might nevertheless be quite sufficient to cause death. From a theoretical standpoint there is no reason whatever why a coronary spasm might not cause death and I have no doubt whatever but that such cases may exist. As a rule, instances of vascular spasm are not limited to a single field, for example, intermittent claudication is very common in angina of coronary origin, and the occurrence of vascular spasm elsewhere should always cause us to apprehend coronary spasm as a possible cause for angina pectoris.

The intensive study of circulatory disease of the past ten years has crystallized our conception of the basic pathology present in angina pectoris. Most of us now agree that the typical picture of angina pectoris may be produced by any one of three frequent lesions. In many instances they are associated.

Disease of the coronary arteries. This may cover a very wide field. No doubt the most common lesion of the coronary vessels is an endarteritis which produces nodal strictures of the lumen. This is probably associated with a certain degree of spasm during the attack. Ordinary arteriosclerosis of the coronaries is also a very frequent change. It may occur as a part of a general process of arteriosclerosis or it may exist in very severe degree in the trunks of

atherosclerosis, finally arrive at the stage of a generalized arteriosclerosis, and angina pectoris. The anatomical lesion most prevalent in these familial cases is that of coronary disease, next in order comes aortic disease, and last of all, the myocardial lesions.

Arteriosclerosis is also a frequent factor causative of this picture in many instances in which no hereditary influence is to be found. In some instances as in syphilis, in lead and gout, there may be a definite cause for the arteriosclerosis evident, but in many other cases no cause may be thus apparent (twenty-five cases). It seems in very many cases that it is not the degree or type of the arterial disease but the individual peculiarity or sensitization which determines whether or not the case will manifest angina. Hypertension is a factor of etiological importance in some cases beyond doubt, but no frequent relationship between hypertension and angina pectoris is seen in the series of cases which is the foundation of this study, though the cardio-vascular-renal complex was a probable cause in thirty-seven of my cases. Hypotension is indeed more frequent than hypertension (fifty cases), but it occurs as an incident and probably not as a causative factor, though Mackenzie evidently believed differently on this point.

Age alone does not seem to be a very great etiological factor, though the syndrome is indeed rare except in adult life, and in the series under special study to-night the statistics show the following:

One case only developed in a patient between twenty and thirty years of age. It was an instance following severe influenzal infection and was probably a result of myocardial disease. Ten cases appeared between thirty and forty years, sixty-six between forty and fifty years, one hundred and twenty-nine between fifty and sixty years, that period of greatest emotional stress, ninety cases between sixty and seventy, twenty-two cases between seventy and eighty, and one between eighty and ninety. Age as the chief etiological factor was noted in but seven instances.

It has long been considered as an axiom that syphilis and angina pectoris are very frequently associated. Indeed I too held that prevalent opinion until actual analysis of my own cases convinced me that I had probably over-estimated this factor (thirteen cases). Syphilis may produce all three types of lesions characteristically mentioned as productive of the complex, perhaps it is most commonly

ciated occurrence of intermittent claudication, abdominal anginas and the like. This association of other definite areas of arterial spasm in this disease has been observed in eighty-one of our series of cases.

Physical stresses as the cause of the symptom of angina are present in practically all well-established cases, the longer the standing the more obvious does the relationship become. On the other hand it is not those whose occupations entail great physical effort who chiefly develop the disease (eighteen cases), but quite the contrary. Physical stress then should be considered not as a productive factor, though in established cases it is one of the most frequent immediately causative agents in so far as the individual paroxysm is concerned.

As we have gone along in our rather rambling conversation on this subject we have incidentally mentioned the problem of diagnosis infrequently. It is not my purpose to attempt to discuss diagnosis in any detail for the reason that I think it far easier to make the diagnosis in the individual case than to lay down hard and fast lines for diagnosis theoretically. My experience as a consultant has been that the average physician, surgeon, obstetrician, or even pædiatrist is usually fully informed on this phase of the subject and I do not believe that it requires any special consideration, but there are a few factors which my experience has led me to wish to emphasize on this question of diagnosis.

Obviously the chief problem is the distinction from pseudo-angina which I have already in part discussed. In diagnosis considerable attention and weight must be accorded to an estimation of the credibility of the patient on the degree and character of his pain. So many of the public are so well-informed on the subject that they are likely to perhaps unconsciously tell a very conclusive story of the disease through their very fear of it. An attractive and brilliant young woman, in her early twenties, recently came to my office with an almost letter-perfect recital of symptoms and her suffering had become so severe that her brilliant future as a musician was seriously threatened. She almost persuaded me that she had an angina, so accurately did she describe it. Fortunately she permitted me to conduct experimental tests which I could never encourage in cases supposedly anginoid, for I exercised her to the extent of exhaustion without inducing an attack. The electrocardiogram was entirely

negative She was hypotensive, very suggestive, appallingly emotional, but absolutely no physical signs could be detected which could account for a basic pathology I finally submitted her to very distressing emotional stress which induced an attack, and the nature of that attack at once persuaded me that we were dealing with an anxiety neurosis for the patient was voluble with her symptoms *during the attack* She could not remain at rest, but walked back and forth in the examining room, there was no cardiac arrhythmia—she was evidently in severe distress, but definitely not from an angina A frank statement backed with a lack of all contributory pathological anatomy finally succeeded in persuading the young woman that her attack was purely an emotional reaction and accompanied by no danger of real cardiac disease She has had no subsequent attacks, and I confess that I myself have been much relieved also for she nearly had me persuaded that she really had an angina The point is that observation of the attack is the most highly diagnostic fact In my opinion the second most important fact is the determination of an adequate pathology A failure to obtain some degree of amelioration under the nitrites is a strong negative point in difficult diagnosis Always the elimination of emotional and hysterical states is a difficult matter In some instances of course a knowledge of the personality of the patient is absolutely necessary in this respect and such an evaluation is always of great assistance in diagnosis

There can be no question as to the high value of the electrocardiogram in the diagnosis of angina pectoris, when it furnishes a positive evidence Negative electrocardiographic findings are of no value, however, either in a positive or a negative way Frequent observers have reported entirely negative electrocardiographic findings even when taken in the height of the attack. Three such instances have fallen under my own observation, and in all the diagnosis was subsequently fully established, in two instances by death, and one by autopsy Neither are electrocardiographic findings constant. In a recent case seen by me in consultation with Doctor Rabinowitz, of the Brooklyn Jewish Hospital, during a quiescent phase, the electrocardiogram showed an absolutely positive picture, but during an attack two days later, the record obtained by the same technician with the same instrument indicated absolutely no pathology This case

was confirmed in diagnosis by an extensive coronary thrombosis a few days later

In many ways the most interesting subject in our present-day study of angina pectoris is that of treatment, and such is my interest and the importance of the subject that I propose to occupy considerable time in its discussion.

The question is frequently asked both by the physician and layman "Can angina pectoris be cured?" In the past it has been largely the custom of many of us to answer such a question with the statement "Only in cases of mistaken diagnosis" Our study of the pathology of the complex, however, in the past few years, associated with the clinical observations which permit of little opportunity for error in diagnosis, has led us to the answer that angina pectoris can be cured in instances in which the basic pathology can be rectified Obviously those cases founded on coronary and aortic lesions are the most difficult of cure in this regard, but many of the cases in which the basic pathology is located in removable or curable lesions of the myocardium can certainly be cured

I have seen cases caused by syphilis, believed to have been based on a coronary or aortic pathology, which apparently underwent complete cure though even in these most favorable instances there was in all probability some definite subsequent limitation of cardiac reserve none the less Many cases presenting quite characteristic clinical pictures, and a few with electrocardiographic positive evidence in which the basic pathology lies in the myocardium, become apparently cured I speak particularly of instances which arise after the acute infections, especially after influenza, pneumonia, tonsillitis and the like Some cases apparently of rheumatic origin have also appeared to undergo complete recovery, though almost if not always with some subsequent limitation of cardiac reserve I am certain that we have permitted the lay public to become convinced of our undue pessimism in regard to this disease, and our pessimism has led in many cases doubtless to ineffective treatment on the part of the doctor and inefficient cooperation on the part of the patient My optimism, particularly in regard to syphilitic cases, I find has led to misquotation in some instances Because early and efficient specific treatment will cure early cases of luetic angina pectoris in not-unfrequent instances, clinicians have concluded that any case due to

syphilis should be cured This is of course very far from the truth When fibrosis has taken place, either in the heart muscle or in the walls of the coronary or aorta, it is not to be expected that cure which is obviously dependent on removal of the underlying pathology can take place, though it is perfectly true that in a very high percentage of these cases great benefit symptomatically and not infrequently a staying of progress can be effected One can never tell except by therapeutic experiment

Disappearance of symptoms is very frequent and it occurs in very many instances beyond doubt, particularly if the treatment is properly administered and introduced before grave tissue changes have taken place As I have frequently said, however, in this paper, disappearance of symptoms is usually associated with a degree of permanent cardiac disability

I have already mentioned that disappearance of the symptoms, that is if the angina occasionally develops when coronary thrombosis has taken place I take it, however, that this disappearance of symptoms is generally associated with an even greater cardiac defect The danger to life is probably in nowise diminished and the patient is perhaps in much the same position as he who has had his cervical ganglia removed or some of the other recently adopted surgical procedures done The thrombosis probably in certain of these instances only prevents further arterial spasm in the particular vessel affected

I have seen apparent complete relief follow in two cases probably caused by gout. Both signs and symptoms entirely disappear under proper diet and medication A few cases under my observation of what I took to be true angina pectoris have received symptomatic cure from the relief of secondary subsidiary factors Thus I have seen cases subside from the giving up of tobacco, the cessation of violent exercise or from a better control of the temper It is most important in the treatment of individual cases to take all these factors into full consideration

The discussion of the treatment resolves itself naturally into the treatment of the underlying disease and that of the paroxysm The former is of course the more important, but the primary effort is to give relief to the acute attacks and in so far as possible to prevent the onset of others I am convinced that there is such a thing as an anginal habit, that is that one attack predisposes to another and, if

attacks are never allowed to eventuate or to come to a climax, there is a definite tendency toward less frequent attacks, the habit tendency instead of increasing as is usually the case becomes lessened. For this reason I think it important that the patient should promptly use his nitrite or such other measures as may be efficient in preventing the development of the complete attack. Rest, elimination of tobacco, attention to abdominal distention, a diet suited to the particular case under study, thorough emptying of the bowel, and especially control of the emotions which induce attacks should be practiced in so far as possible. In this regard there is a well-known fact infrequently mentioned in the literature but exceedingly important and well recognized by most clinicians, namely that sexual excitement is exceedingly inadvisable in these cases. The number of cases which die under such conditions is large.

I do not believe that it is necessary for me to enter closely into the discussion of treatment of the acute paroxysm. In the first place most of you are already familiar with the best methods. There are few but most insistent demands and the drugs which we have at our disposal are not numerous. The one drug which will give the most absolute relief in severe attacks is morphine. I have seen instances so severe that as a humanitarian measure, I gave chloroform. I have never had a patient die under the drug, and I believe that it is justifiable in some instances. Morphine will usually suffice, but it must be given courageously.

Many attacks are immediately relieved by the nitrites, either the inhalation of amyl nitrite or by the taking of nitroglycerine by mouth or by hypodermic. There is nothing in the theory that nitroglycerine acts more quickly when given by holding it under the tongue than when it is swallowed. The liquid preparations of nitroglycerine are usually more efficient and it is wise for the patient to carry in his pocket a small phial of spirits of glonoin freshly prepared each day for emergency use, unless perchance it has been found that the tablets, usually hypodermic ones, are equally efficient. When the ampouls of amyl nitrite are found effective they are perhaps most convenient but they are usually not so prompt in effect as nitroglycerine. Even in the management of these acute attacks you will find that a singular amount of individual peculiarity exists, and it is well worth your while to try to study out these special reactions so

that your patient may always receive the maximum benefit as promptly as possible. Of course when coronary embolism occurs a special line of treatment which involves the liberal use of morphine, chloral and profound rest must be instituted. Time will not permit us to consider the treatment of coronary thrombosis.

When the paroxysms are very frequent and severe, confinement to bed is very advisable at least until it can be experimentally determined that the attacks are not decreased by this measure. There are unquestionably many cases which do better if allowed up, about, and some at their customary occupations. In this respect as in all others in this problem, it cannot be too insistently emphasized that individualization is absolutely essential in the treatment of this condition, it is imperative. Exercise is another matter which must be determined only by experiment. Usually it should be diminished to merely that of necessity, but there are exceptions. So great is the emotional factor in this complex that it is often better to permit the patient to do at least some of his ordinary work, if thereby he is rendered more content and happy. I have had many instances in my experience which demonstrate this point absolutely. Throughout it must be most positively recognized that in this disease emotional stresses are even more important than physical ones.

These general measures having been put into force, the next most important thing is to attack the basic pathology of the disease. In case it is due to syphilis, specific treatment must be given, and it is very inadvisable to use the arsenical preparations until the patient has first been brought well under the effects of mercury, iodide or bismuth. In case of a basic gout, colchicum, atophan and the alkalies, water and a suitable diet are to be enforced. In case the basic pathology is a myocardial degeneration, rest and the elimination of the causative factors in so far as possible are imperative requirements. The same is true of acute myocarditis, such as for example may occur in rheumatic fever. There can be but little doubt but that the salicylates in these instances sometimes at least effect much benefit. I have seen cases get more actual relief from the salicylates than from the opium preparations in these cases.

In fibroid myocarditis and occasionally also in myocardial degeneration digitalis occasionally gives great relief, both in relieving the severity of the paroxysms and in lessening their number. In

coronary cases it gives little or no relief, and oftentimes makes the attacks more severe and frequent. It may be tested out experimentally, however. In all cases, except in thrombosis, the vaso-dilators are tremendously beneficial and the nitrites, nitroglycerine, sodium nitrite, erythrol tetranitrate and the like are all used successfully in the prevention as well as in the relief of attacks.

Sleep and rest are of crucial importance, and when they may not be obtained otherwise the opium preparations are advisedly if not compelledly given. The vaso-dilator sedatives, led in efficiency by chloral hydrate and similar drugs, are beneficially given, at bedtime particularly. Alcohol, recommended many years ago by Heberden and others of his time, has a very definite benefit in many cases, especially among the aged and arteriosclerotic. Such sedatives as the bromides, barbital and the like may be employed habitually for long periods.

The spiritual side of the case must not be neglected in this disease in which the emotions play so important a rôle. The development of a philosophy of life, of the power of adaptation of desire to possibilities, the cultivation of suitable hobbies of a restful character, such as suitable reading, music and such pacific occupations as painting, etching, carving and similar pursuits, are of real medical benefit. Habits of restfulness and relaxation are to be cultivated. Climate is often very important and those who live in the temperate zones may well spend their winters in the south or perhaps go to live permanently in some mild, temperate and congenial climate. Few patients do well in the cold places or at high altitudes.

Meantime attempts at the maintenance of cardiac reserve must be made, the use of massage when exercise is impossible, and a diet must be devised suitable to the particular needs and metabolic peculiarities of the patient.

Each case must be made an individual problem. If possible the patient should be seen at frequent intervals, at least until a complete and correct appraisal of the person as well as of the disease and lesion has been made, and treatment should be adjusted to such needs, physical, mental and medical as the individual instance will dictate. I am certain that those of you who can and will take the time to study your cases of angina pectoris as carefully as you do your cases of nephritis or pneumonia will find yourselves richly rewarded by such results as will in many instances greatly surprise you.

DIGESTIVE PROBLEMS IN OLD AGE

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IN DISCUSSING the digestive problems of old age, it is well to remember that a considerable portion of the happiness of the old is dependent upon the condition of their digestive apparatus. Age has its compensations, for the interests of the soul, even the activities of the mind, may be enhanced by the broader and kindlier vision and the philosophic calm of increasing years, but they become as dust and ashes if the tongue be coated and the stomach awry.

Roughly speaking, as we see it, the digestive problems of old age may be divided into first, those conditions which in their nature represent a part of the aging process—arterio-sclerosis, atrophy of the digestive glands and of the muscular apparatus of the digestive tract, and the digestive disturbances which are due to similar aging or senile changes of other organs and tissues, notably the heart and kidneys, and second, the rôle old age plays in conditions met with in all ages, although obviously in certain cases more prevalent as age progresses, but in which the diagnosis, the treatment and the prognosis are modified by the age of the patient. In this connection we will discuss ulcer, appendicitis, other inflammatory conditions, and last and most important of all—gastro-intestinal carcinoma.

As we see it, the manifestations of arterio-sclerosis, which, after all, in many cases is but a sign of age, yet in other cases a definite sign of disease, may be roughly grouped into three divisions: first, the digestive changes due to the disturbance of function brought about by the sclerosed arteries, ranging from slight dyspeptic symptoms—fullness, distention, discomfort after eating, constipation, intestinal dyspepsia—due presumably to the disturbance of blood supply and the effect of this upon secretory and motor function, and running the whole gamut from these relatively mild symptoms to a picture in which digestion in all its phases is so inhibited that we have a picture very similar in most respects to that of carcinoma, gradually leading to progressive inanition and death.

According to Fenwick, twenty-one per cent of all elderly individuals suffer from this condition, and the histological picture is progressive sclerosis of the arteries, new connective tissue formation about the diseased vessels and secondary progressive disturbance of glandular and motor apparatus. These cases are difficult to treat, because after all it is age and not disease that we are treating, but they may often be made much more comfortable by recognition of the underlying pathology and proper symptomatic therapy.

In our second group, a relatively small one, arterio-sclerosis leads to ulceration of the stomach, duodenum or intestine due to emboli or thrombi and sometimes producing the classical picture of gastric or duodenal ulcer, often associated with a large hemorrhage, which may even be more marked if the process is associated, as it often is, with varices in the œsophagus, stomach or intestine. In these latter cases the hemorrhage may be very alarming and sometimes fatal.

And third, abdominal angina, an exact analogue to true angina, due to closure by sclerosis and spasm, or thrombosis of certain of the abdominal vessels, and bringing about attacks of agonizing local pain. It is a difficult problem to diagnose this from those cases of true angina where the symptoms are mainly abdominal as is sometimes the case, but the greater frequency of the attacks, the complete absence of any cardio-vascular symptoms and the finding sometimes of occult blood in the stool, give us our clue, although one must never forget that the burden of proof in these suspected cases is always upon us when we make this diagnosis and in the vast majority of cases of so-called acute indigestion in the old, we are dealing not with abdominal angina, but with true angina, with mainly abdominal symptoms and signs and where, unless we recognize this and give the appropriate treatment—rest, starvation and most important of all, morphine—a fatal outcome may be the result.

If one cares to study the secretory findings in these cases of arterio-sclerosis, one is struck by their marked tendency to subacidity or achlorhydria. Seidlin, for instance, found a complete lack of hydrochloric acid in twenty-four out of forty cases, Liefschutz in one-half of sixty cases studied.

An even larger group of digestive disturbances trace their origin to the retrogressive changes of the glandular apparatus and smooth musculature which is incidental to growing old. Teeth decay and

drop out, the tongue becomes smooth and atrophic, there is atrophy of muscle and disappearance of glands—this is age as it reads itself into the digestive apparatus and this brings in its train a multitude of symptoms often bizarre and protean which we must analyze and unravel if we hope to bring to our patient relief or even a modicum of comfort. Why do we grow old and what is age? Living bacteria are to be found in tombs sealed for centuries. Microscopic organisms and living cells can have their life cycles almost indefinitely prolonged by constant change of media. And yet the human body grows old willy-nilly and no attempt at changing the bacterial flora in the intestine nor the transplantation of glands of sex or growth has added a jot or a tittle to our span of life, although preventive medicine, hygiene and proper health procedures have raised the average length of human life by lessening the death rate in preventable diseases.

To quote from Cohnheim's delightful lectures on General Pathology—

"Inquiring into the causes of senile atrophy—which is well known to the laity, and for which the term senile marasmus is also employed—we find, certainly, that a determining influence is in the vast majority of cases exerted by tangible pathological factors. In one instance it is a disturbance of respiration, in another of digestion, in a third of the nervous system or of the renal function that forms the first link in the chain of processes, more or less morbid, the result of which collectively is senile marasmus. Nevertheless, an individual who had never passed through any actual illness would in old age most certainly become the subject of senile atrophy. It is in my opinion the constancy with which in aged people a more or less marked atrophy of *all* the organs sets in, quite independently of the number or character of antecedent pathological processes, that clearly favours the view according to which the conditions determining the occurrence of senile atrophy are, so to speak, physiological. True, the conditions are only with difficulty discoverable, and their nature is certainly complex. A wear and tear, such as occurs in machinery, must evidently be confined to tissues whose metabolism is slight and whose permanency is consequently great, it was thus I explained the decrease of elasticity in the arteries of old people. No such change can take place in the great majority of organs, simply because they are continually undergoing transformation and renewal, so that the individual elements composing the tissues and organs are in aged persons by no means old. The principal question appears to me to be whether, when the necessary material is supplied them, the faculty of self renovation, *the reproductive power of the cells*, is really unlimited. All these matters are involved, indeed, in the deepest obscurity, and, as I should be the last to deny, nowhere in this have we a secure foundation to build upon. Yet, if we fix our attention on the development of an organism, noticing how

rapid is its growth at first and how this gradually becomes feebler, and attempt to understand the laws of its causation, we shall again and again find ourselves inclining to one and the same hypothesis. This is the existence in the component cells of the organism of an inherent reproductive capacity transmitted by inheritance, most active in early life, and as age advances losing energy little by little, till after a time it just suffices to maintain the size of the body or its parts, and at last fails to do this. But we should then have discovered the principle at the root of senile atrophy, the further progress of which must in many ways be assisted by the gradual appearance in its train of functional disturbances, *e g*, of digestion, circulation, blood production, etc."

It is the failure of this inherent reproductive faculty that is the basic cause of the digestive symptoms of the old. The *teeth* become diseased, pyorrhœa and periapical abscesses develop and yet an immunity in most cases seems to be acquired, or drainage is so free that no absorption takes place, so that in many cases in the old no symptoms can be honestly referred to this pathological condition of the teeth. It is a wise physician who retains the teeth of the aged, albeit scanty and diseased, as long as possible, unless he is absolutely convinced that they cause disease elsewhere, for in the old, the fitting of plates is often difficult or impossible and it is a poor consolation to the patient to know that he no longer harbors potential foci of infection, if he may no longer chew, and must perforce live on pap.

The *tongue* becomes smooth and atrophic. It resembles often the tongue of pernicious anæmia, and if one cares to delve further, one will usually find it associated with a gastric achylia and also with a deficiency in pancreatic secretion. Is it the forerunner of a primary pernicious anæmia which never develops because the waning span of life is too short?

In the *stomach* and *intestine* in old age, the increasing weakness of the muscle fibres leads to atony, "there is a diminution of gastric and intestinal secretion with atrophy of the mucous membrane which becomes smooth and finally is converted into a thin layer of connective tissue, there is overgrowth of the tubules by connective tissue, the rugæ of the stomach are no longer marked and there is fatty degeneration of the muscular coat."

All who have studied these cases know the acid gradually diminishes in most cases and in many is completely absent from the gastric secretion, while similar studies far more difficult to make technically show a like diminution in pancreatic and intestinal ferments.

Dedichen, for example, examined the gastric contents of 100 healthy people between the ages of 87 and 92 and found that four-fifths of the men and three-fifths of the women had an achlorhydria—suggesting perhaps that even such a ruthless enemy as time deals perhaps a bit more gently with the so-called gentler sex, in all these cases the emptying time of the stomach was abnormally rapid. As regards the motor side, if one examines the old under the fluoroscope, he is struck with the increasing frequency of atony, often associated with ptosis of the stomach and colon as age progresses.

It is this lessening or disappearance of secretion, this increasing atony of gastro-intestinal musculature that is the cause of the digestive symptoms of the old—sometimes there are no symptoms because they discount their digestive infirmities by better habits of living, oftener they present the simple picture of a subacid, atonic dyspepsia with its feeling of early repletion, fullness after eating, its anorexia, its flatulency, its constipation or diarrhoea—all aggravated, of course, by the indiscretions of diet to which even the old with their acquired wisdom and experience are somewhat addicted in this age of Augustan luxury, but in some cases the symptoms are much more severe and simulate those of gall-bladder disease, ulcer or cancer, due in one case to traction on the common duct, in another to the pull of a ptosed atonic viscus on a fixed pyloric duodenal juncture, and in still another to associated disturbance of blood and nerve supply.

In the treatment of these dyspepsias of the old, these pictures with hyposecretion, atony and deficient assimilation as their component parts, a realization of the underlying pathological processes should give us our therapy—small meals, not objected to as a rule as everyday experience shows that old people not only consume less food—which may be explained by a diminution of their metabolism and the weakening of their conditioned gastric reflexes, but prefer soft and easily digestible foods to more heavy foods—a smooth diet, limitation of fluids with meals, hydrochloric acid and strychnine, control of the associated constipation and diarrhoea, posture and abdominal support, proper exercise or exercises and massage, and of greatest importance of all, *rest*, for rest, if properly used, is our most important therapeutic agent in the treatment of the dyspepsias of the old. In them the organs become fatigued, weary with well or ill doing, and a few days' rest in bed, or an hour or two daily in the

prone position will often do more in intractable cases than all the drugs in the pharmacopœia or the most intricate and mysterious forms of electric therapy

In connection with these dyspepsias of the aged, it is well to remember that in certain cases the fundamental cause of the symptoms is not to be found in the digestive apparatus *per se*, but is due to degenerative changes of the same origin in other organs, with reflex, circulatory, or toxic gastro-intestinal manifestations. Perhaps the most interesting group is that in which these digestive symptoms represent the first and often the only sign of a beginning myocardial degeneration, and where from five to ten drops of tincture of digitalis, three times daily, which often must be kept up indefinitely, will relieve almost instantaneously symptoms which have been absolutely resistant to the treatment based on the conception that the condition was fundamentally gastro-intestinal in origin. It is a wise rule, one learned from my old master and beloved chief, Sir William Osler, never to neglect this experiment in therapy in the intractable flatulent dyspepsias of the aged, especially if upon the burden of years has also been superimposed the onus of fat.

Another group almost equally interesting is that of an unrecognized nephritis, a small contracted kidney, where the anorexia, nausea and vomiting, loss of weight, cause a picture extremely suggestive of carcinoma of the stomach. Hardly a month goes by that I am not called in to see a case so diagnosed as malignant disease of the stomach, where a thorough study shows the symptoms to be purely renal in origin.

And in the old, diseases elsewhere, senile changes in central nervous system or in lungs or possibly in endocrine apparatus may present a picture almost purely digestive in nature.

But it is not so much this atonic, subacid dyspepsia, with, as a rule, its vague discomforts, that brings these patients to the physician, but it is their two major complaints—intractable constipation or persistent diarrhœa, or an alternation of the two. Now this diarrhœa may be simply an expression of weakened musculature and loss of sphincter control, as the constipation may represent atony and poor propulsive power, but in many cases the process is far more complex and may require very careful study before its true nature is deter-

mined, for we must never forget that diarrhœa and constipation are only symptoms with myriad causative possibilities

As to the *diarrhœa*, perhaps the most interesting is the so-called gastrogenous diarrhœa, very common in the old—the diarrhœa of purely gastric origin associated with a complete absence of hydrochloric acid in gastric contents, although for some reason which we do not understand, many cases of gastric achylia have a normal or sluggish stool

In the morning diarrhœa of the old, especially in those with few or no teeth, always suspect a gastric achylia as the probable primary cause. A test-meal will demonstrate whether the conjecture is correct, and a cure is obtained almost immediately by the administration of dilute hydrochloric acid, in very small doses—incidentally, twenty or thirty drops with meals—which suggests that in these cases it is rather some rôle which the acid plays in the elaboration of a motor hormone, than disinfection of gastric or intestinal contents or as an aid to protein digestion that is the cause of this most brilliant therapy

A much smaller group but one of equal interest is that where stool study shows impaired fat and starch digestion and where careful quantitative studies of stool or duodenal contents show a marked diminution or deficiency of pancreatic ferments—the so-called pancreatogenous diarrhœa, often much helped or cured by pancreatin or diastase and calcium lactate, sometimes combined with parathyroid extract, and really resembling in a mild form both as to symptoms and therapy tropical sprue, where we showed years ago that absence or diminished pancreatic secretion was the rule in most cases

And last—never forget the false diarrhœa of carcinoma of the colon—in reality simply an expression of irritation due to the partial obstruction by the malignant disease invading the lumen of the gut

As to the *constipation* of the aged—while in many cases it is but an expression of the atony of their musculature, and is often associated with varying degrees of true colitis, in many other cases its origin is quite different.

If it is simply an atonic constipation—diet, massage, mineral oil, or agar or possibly some form of laxative or mild purgative is usually successful in its treatment, though in certain very rare but



very severe and intractable cases, heroic measures, even surgery, appendicostomy, cecostomy, or partial resection may be necessary

The view that most of these cases present symptoms of intestinal auto-intoxication is a peculiarly unfortunate one for in the vast majority of cases there is not a scintilla of evidence that toxins of intestinal origin play any rôle in the production of the symptoms presented, which incidentally can be adequately explained by the associated disturbance of blood or nerve supply or on purely psychogenic grounds

This popular viewpoint has also given rise to pernicious therapy—absurd dietetic restrictions and repeated colonic irrigations with huge amounts of fluid. Those who advocate the last mentioned form of treatment do not realize in the first place that this daily distention of the gut must lead to dilatation, atony, and increasing difficulty in bringing about normal elimination, while in the old there is very real danger because of the effects of a sudden rise in blood pressure sometimes incidental to the treatment, and in the second place, that if the absorption of toxins does play a rôle, it is infinitely more likely to occur from the liquid fæces of an irrigation than from the most stubbornly constipated stool, while the streptococci found in abundance in such washings and often utilized in the preparation of generally useless and not always innocuous vaccines because they are regarded as pathogenic, are in reality simply the normal habitants of the ileum brought down from their high estate to lower levels by this treatment, as Paulson has shown in my Clinic.

But in many cases it is not so much atony that causes constipation in the old as faulty habit, and it is surprising in how many cases a regular daily evacuation may be brought about simply by installation of a daily habit, diet and hygiene and the driving out of that devil of devils, fear of so-called intestinal toxemia, and the persistence of the doctor. Sometimes it takes almost superhuman powers of persuasion, often the abused colon takes many days before it begins to respond, but the results are often brilliant if the physician has faith in his method and the patient has faith in his, or more often her, doctor.

Another form of constipation often met with in the aged is the so-called dyschesia—rectal constipation—where the sole cause is a lowered sensitiveness of the rectal mucosa to mechanical stimula-

tion, perhaps congenital, perhaps the end result of constipation of long duration, or persistent failure to respond to the urge of defecation. These cases are easily diagnosed by digital rectal examination and X-ray study, but in their therapy, for a time at least, we have to combine with dietetic and lubricant treatment and the installation of habit, certain other measures—a small oil instillation of two to three ounces or a small hot water enema.

The constipation of mucous colitis in the aged, which here represents a combination of a myxoneurosis and a true catarrhal colitis, is, as in other ages, best treated by psycho-therapy, a smooth diet, heat, lubricants, anti-spasmodics, castor oil in small doses, or oil by rectum.

As the last type of constipation in the aged, we must mention that of endocrine origin, and this is by no means a negligible group. In the last few years we have studied by basal metabolic measures 150 cases of severe constipation in women ranging in age from the late forties to the seventies, in about one-half of whom an unrecognized hypothyroidism, a *forme fruste* of myxedema, seemed to be the underlying cause, as in all of these the readings were less than minus 10 per cent, and in more than one-half less than minus 20 per cent, while I have seen few more brilliant results than the cure of their constipation by thyroid therapy in these cases.

And now let us take up the other and perhaps more important phase of the digestive problems of the old—that of the rôle played by age in our analysis of the signs and symptoms, in our decision as to therapy and in prognosis, in diseases of the digestive tract met with at other ages as well as in the old, although obviously in certain cases, notably cancer, much more common as age advances.

In diagnosis and therapy and in prognosis, age plays a definite part in all these conditions. Symptoms are often not so clean cut in the aged, for we must never forget that it is not so much the organic lesion that is the cause of the symptoms presented as the functional disturbance produced locally and reflexly and that in the old the clinical picture presented which would be clean cut in the young is often blurred and indistinct, due to the lessened affectivity of the old, their lowered response to stimuli and the fact that in the old there are often other functional disturbances present due to sclerosed arteries, weakened muscle and less active glandular apparatus. As

regards therapy, especially if the treatment is surgical and as regards prognosis, our judgment is always consciously or unconsciously tinged by our knowledge that the patient is old. The old as a rule take anaesthetics less well, they are more likely to develop post-operative pulmonary complications, their resistance to infection is lowered, and this sometimes means that the slimmer chances of the old are, and sometimes quite unjustifiably, further imperilled by delaying operation or deciding against operative treatment in conditions obviously only surgical.

In our experience, *duodenal ulcer* is almost as prevalent in the old as in those of middle life and its diagnosis is made by the same criteria—the history with its trinity of symptoms, hunger pain, punctuality, periodicity—aided of course by X-ray and fluoroscope, stool studies and analysis of gastric contents, the last, however, of far less importance than at other ages because in ulcer of the old lessened gastric acidity and even achlorhydria are not uncommon. It is for this reason that the differential diagnosis between callous ulcer of the stomach and carcinoma is often very difficult, sometimes impossible, and only determined from histological study of the specimen if it is removed surgically. It has been our experience, however, that considerably less than 5 per cent of gastric ulcers undergo malignant degeneration, while in the case of duodenal ulcer no such degeneration takes place.

The treatment of ulcer in the old is practically the same as at other ages: soft diet, frequent feedings, control of the bowels, development of a proper mental attitude on the part of the patient, the avoidance of psychic strain, and the proper amount of exercise and rest.

As we see it, in chronic ulcer the results of treatment are often not satisfactory, be it medical-dietetic or surgical, though in the former case it is frequently lack of persistence in treatment rather than the treatment *per se* that spells many failures that might have been potential successes, while, in the case of the latter, age *per se* is not a contra-indication for surgical treatment if absolutely indicated. On the other hand, in our experience surgery is only indicated if there is gross organic obstruction, suspicion of malignancy, such extensive perigastric or periduodenal adhesions that comfort can be obtained by no other means, or possibly frequently recurrent

hemorrhages, and in many surgical failures the lack of success is because operation is advised when it is not indicated. Anyone who honestly studies the ulcer problem cannot fail to be bitterly disappointed by the results of treatment, be it medical or surgical, in a large number of cases, and for this reason one should obviously never advise surgery in the old unless its immediate need is imperative or until all other measures have been tried long and conscientiously without success.

Hanrahan from a very careful study of Finney's series, found an operative mortality in duodenal ulcer of 5.8 per cent below fifty and 10.5 per cent above fifty, while age had very little effect on the condition of the survivors of operation.

In certain cases where anti-spasmodics and where other measures usually used to control pain have proven ineffective and where this pain has not been relieved by the greatest of therapeutic measures—rest—we may get relief by large doses of inert substances such as barium sulphate or kaolin or bismuth subnitrate, which probably act by lowering surface tension, or by non-specific protein therapy in which the results obtained are probably due to their effect upon the sympathetic nervous system.

The opinion that one of the compensations of age is its freedom from *acute appendical attacks* is unquestionably erroneous. We have seen three acute cases in the past six months in patients over seventy years of age, in two of whom there had been absolutely no history of previous attacks, and Finney and I are both convinced that it is distinctly more prevalent in the very old than it was twenty-five years ago.

A far more interesting group of cases is that where a *chronic appendical lesion* is at the root of the symptoms, sometimes local—more often referred elsewhere. What is chronic appendicitis? Many surgeons deny its presence, others insist that it is only justifiably used when there have been definite acute attacks, and in the main, but not altogether, I agree with this in principle. For I feel that in the vast majority of such so-called chronic appendicitides the case is in reality a low-grade inflammatory process, involving terminal ileum, cæcum and ascending colon as well as appendix, a perityphlitis if you will, usually found in visceroptosis with chronic constipation and therefore obviously common in the old, when operative treatment

usually does irreparable damage, adding post-operative to pre-operative adhesions and making the second state of the patient far worse than the first. But I am sure that there is a true chronic or subacute appendicitis, where the most careful analysis of history or examination of patient fails to incriminate the appendix and yet where there is definite localized appendical disease. As I find it, these cases have constant, or much more frequently, periodic gastric discomfort, often almost typical of duodenal ulcer, sometimes even slight hæmatemesis or melæna, suggesting an associated duodenitis or duodenal erosion, they are almost always constipated, with symptoms that do *not* yield to treatment based on the assumption that the disease is duodenal or purely functional in origin. In the diagnosis of these cases, we have been most helped by repeated fluoroscopic studies, showing an appendix, often long, segmented, kinked, often sensitive to palpation, often very slow in emptying, even after large purgative doses of magnesium sulphate. Often the blood shows a slight leucocytosis, 9,000 to 12,000, sometimes definitely increased by deep palpation and by exercise. We have an ever-increasing group of such cases where surgery has been followed by complete relief of symptoms and where the pathologist has reported a marked chronic inflammation in the removed appendix, and where without these criteria we could not have made the correct diagnosis.

Of course a visualized appendix after barium administration is not necessarily diseased, but if it is kinked or segmented or adherent or bulbous, if it remains filled for several days even after active purgation, and if it is persistently tender on deep palpation under the fluoroscope, it is in all probability pathological, and even in the old, if relief is impossible by diet and medication, surgery is absolutely indicated, with, of course, special safeguards, notably local anaesthesia.

The *pancreas* is a most neglected organ. When we think of its importance in the human economy and the infrequency with which a diagnosis of pancreatic disease is made, we cannot fail to feel either that it has a singular immunity from disease or that diagnostic criteria of its disease or dysfunction are sadly lacking. Each of these is probably true. Its position and blood supply make it peculiarly protected, while this same inaccessibility makes it difficult to determine whether it is functioning normally or abnormally, or whether

it is the seat of disease And yet I am quite sure that it functions abnormally and is the seat of disease far more frequently than is usually supposed, and that some, at least, of the degenerative changes common to other organs in the old are to be found here as well with signs and symptoms—vague, bizarre, difficult to diagnose, but present just the same

It is needless, of course, to mention the obvious though rare lesion known as carcinoma of the head of the pancreas, with its increasing asthenia and malnutrition, its progressive, painless jaundice, its enlarged gall-bladder, its vague central nervous disturbances, such as inequality of the pupils probably due to an increased retention of pancreatic ferments in the blood, or its temporary relief by cholecystogastrostomy But it was while studying the pancreatic ferments and finding them completely absent in stool and duodenal contents in most cases of carcinoma of the head of the pancreas that I became interested in the study of these ferments in other conditions We found a marked diminution though not absence in many chronic wasting diseases and especially in certain old people who showed vague and sometimes rather inexplicable intestinal symptoms A definite normal was established—a normal for young, healthy individuals This, for instance, in the case of the diastase of the stool varies from 600 to 2400 units, but in certain cases in the aged with the symptoms mentioned above we could find only from 60 to 240 units with a corresponding diminution in trypsin, so that I feel quite sure that chronic pancreatitis is not uncommon in the old, that it may be suspected at least by careful quantitative study of the pancreatic ferments in stool and duodenal contents, that it may cause many digestive symptoms, usually intestinal, or add to those already present, that it may, as mentioned before, be one of the causes of certain intractable diarrhœas of the old, and lastly the use of pancreatin in certain of the vague gastro-intestinal dyspepsias is sometimes followed by brilliant results

In discussing the questions pertaining to diseases of the gall-bladder and biliary diseases, I shall base the remarks on my own experience, and not upon the copious literature upon this subject

First, the frequency with which these cases have only gastric or duodenal symptoms, sometimes banal,—gas, fulness, coated tongue—sometimes associated with profound hemorrhage from stomach or duodenum, definitely simulating

the picture of gastric or duodenal ulcer, where the hemorrhage is probably due to associated mucous erosion or to varices, these cases being singularly likely to be found in the old, due to the senile changes in the vascular system. And lastly, cases which absolutely simulate gastric carcinoma with anorexia, loss of weight, and strength, gastric achylia, while an adhesion from gall bladder to stomach may cause a persistent filling defect in the fluoroscopic image or the X ray plate that the best radiologist will read as definitely diagnostic of malignant disease.

Secondly, certain cases present only cardiac symptoms, presumably through reflex vagal stimulation simulating myocardial insufficiency, often of a marked degree, or even anginoid attacks.

How shall we treat these cases of gall-bladder and biliary tract disease? This is a real problem of old age because there is a very marked increase of such diseases, notably cholelithiasis, as age progresses, especially in the case of women who have borne children. And this increase, marked after sixty years of age, possibly due to the presence of larger amounts of cholesterol secondary to increasing epithelial disintegration in the bile of such individuals, makes our decision as to therapy of especial importance in old age. We also know how disappointing surgery has been in many cases, how frequently a partial obstruction of the common duct, or at least symptoms suggesting this, appears as a relatively late post-operative sequel. And how dangerous gall-bladder surgery, as in fact all upper abdominal surgery, is in the old. Metzler, for instance, found in patients over sixty years of age a mortality of twenty-four per cent. in gall-bladder operations for cholelithiasis, forty-four per cent. in cases operated upon during an acute attack, and eight per cent. if an interval operation was performed.

I am therefore rather loath to advise operation for gall-bladder disease in the very old unless absolutely necessary and unless the attacks are so severe and so frequent and so impossible to relieve otherwise that operation is the only course. And I also have but little faith in the so-called non-surgical biliary drainage in helping these cases. But I think a great deal of help can be obtained in most cases by the application of simple physiological principles—methods to promote biliary flow, to lessen duodenal stasis and to minimize absorption from the large gut,—small, frequent meals, with an increase in the simpler fats such as butter, olive oil and egg yolk, simple salines such as magnesium sulphate or Carlsbad salts before meals (a recent work in our Clinic seems to show that hypertonic solutions

of these salts, which are most effective, retain their hypertonicity in their passage through the stomach in many cases), local heat either by external application or by hot water by mouth, and possibly the use of bile salts and minimum doses of calomel—one-tenth to a twentieth of a grain nightly. While these measures may not cure, they sometimes give immeasurable relief in many of these biliary tract affections of the old and are always worth trying.

Cancer is and always will be the subject of supreme interest to physicians and laity. Its consideration is of peculiar importance in this discussion, because while met with occasionally in early life, it is peculiarly a disease of later life and old age.

Thiersch, as is well known, was the first to lay stress on the importance of advanced age in the etiology of cancer. He pointed out that in old age the connective tissue of the body atrophies, and is consequently no longer capable of opposing the ingrowth of the cutaneous epithelium, which maintains to the last a greater vitality and continues to produce cells.

To again quote Cohnheim—"In all places where cellular material possessing a vigorous power of proliferation comes into contact with the aged tissues of the body does this relation prevail. It is indeed an old established rule, though not without exceptions, that the carcinomata do not make their appearance till after the fiftieth year of life, and if we translate this into our language and say that epithelial tumors do not become malignant before this period, this simply means that one of the signs of senile decay of the body is the feebleness of its tissues or their lessened physiological capacity for resistance."

On the other hand, growth is slower in the aged, sometimes so slow that the tumor seems almost benign—metastases occur late and these facts are of course never to be forgotten if surgery is being considered, as they may more than counterbalance the contra-indications to operation which age entails.

Cancer seems to be on the increase, but how much of this is due to better methods of diagnosis and ever-increasing interest in the disease, how much to the steady increase of the average age of man, with—*ipso facto*—the increasing incidence of diseases more frequently met with in later life, and how much to a real increase in the disease, irrespective of age, and possibly caused by errors and

accidents peculiar to an increasingly complex civilization, it is hard to say

The neoplasms in chimney sweeps and cotton spinners and in those working with aniline dyes and tar, the tar and paraffin tumors in experimental animals, Fibiger's observations on the spiroptera neoplastica, various observations as to the rôle played by other parasites as *Bilharzia* (*Schistosomum*) in the causation of new growths, the skin cancers following exposure to X-rays, all seem to show that "there is much evidence, both clinical and experimental, that chronic irritation induced by various agents may be followed by carcinoma" But whether due to trauma, to heredity, to a living external virus, to a tissue ferment, to some metabolic error, it is the greatest of the digestive problems of old age, for gastro-intestinal cancer is the most common of all forms of malignant new growth and its early diagnosis and proper treatment is our greatest duty

Whether in the growth of the cancer-cell certain metabolic disturbances occur, an increase of antitrypsin in the serum, of phosphorus in the red blood-cells, abnormal metabolism of the carbohydrates, etc., and whether these changes may be utilized in the early diagnosis of cancer, must be one of the main problems of the future—but at the present writing, these changes are not sufficiently constant, or scientifically established to be of much value in diagnosis and we must therefore depend on simpler, more crude, but, at the same time, more dependable data to make our presumptive diagnosis

Cancer of the œsophagus should be ideal for treatment were it not for the great technical difficulties involved. Difficulty in swallowing, especially in older people, and, if progressive, should always make us suspect œsophageal carcinoma. We must not forget, however, that occasionally this dysphagia is remittent, so that even with periodic remissions, so much more common in spasmodic contraction of the œsophagus, carcinoma cannot be ruled out, but, by and large, it is the progressive dysphagia of elderly people that, in the majority of cases, is due to cancer of the gullet. These cases give early symptoms, they metastasize relatively late, the diagnosis is usually confirmed by fluoroscope and radiograph, by œsophagoscope, by stomach tube or olive bougie, or by methods designed to show the pathology in finer detail

While temporary relief may be obtained by dilatation with olive

bougie or by gastrostomy, the only hope of cure lies in surgery and surgery in the relatively early stage of the disease is possible in these cases. In our opinion, X-ray, radium and colloid metals have been absolutely ineffective in the treatment of these cases and surgery is our only hope, but at the present writing the technique of the operation is so difficult that very few cures have been recorded. But we have faith and are waiting impatiently for a Moses to lead us out of the wilderness as Cushing and Frazer and Ellsberg and Dandy have done in what was formerly regarded as an equally unpromising field—that of brain surgery.

In the case of cancer of the stomach, the difficulties of *early* diagnosis are immeasurably greater with the chances of surgical cure much increased. In the vast majority of cases—more than 80 per cent, according to our own statistics—there has been *no* previous digestive history, in fact, it is the development *de novo* of digestive symptoms in people usually of middle and later life, without obvious cause, and not yielding quickly to symptomatic treatment that, at the present writing at least, is our *one most valuable* aid in reaching a diagnosis of gastric cancer, more valuable than X-ray or gastric analysis or stool or blood studies, because it should arouse our suspicions as to the potential cause, should suggest the advisability of making all other tests that might throw light upon the condition, and thus be the factor to make what is essential as regards therapy and prognosis—a relatively early diagnosis.

Cancer of the stomach is very common—next in frequency to uterine cancer, even more frequent in certain countries—it is in the vast majority of cases primary, its site of election is not pylorus or cardia, but lesser curvature, the silent area, where it may grow for a surprisingly long time and reach a considerable size before producing noticeable symptoms, and whence by extension it later may reach pylorus or cardia, and produce the characteristic obstructive or stenotic symptoms, it may be very cellular, with early ulceration, metastasis and striking toxemic symptoms, it may be very acellular, with symptoms largely of a mechanical nature.

It is wise to divide gastric cancer into three sub-groups—First, and by far the largest, in 80 per cent or more, according to some 90 per cent, of all cases when there has been no previous digestive history.

Second, cancer developing upon a chronic ulcer base—not more than 5 per cent in our series—from 1.1 per cent to 3.4 per cent in Anschutz and Konjitzny's series, even less according to Plaut, who calls attention to a point we also have frequently made, that in some cases the ulcers found in the stomach with carcinoma are not primary, but secondary to the cancer itself, due to disturbances of blood supply.

Third, cases preceded by a long history of digestive disturbance, presumably chronic gastritis or functional dyspepsia, in our series somewhat over 5 per cent.

In reaching a diagnosis, we should give to the *history* of the case, real priority, in the first group, the development of digestive symptoms in those with no previous digestive history, with no apparent cause and not yielding quickly to symptomatic treatment, in the second and third groups, the change in the digestive picture.

While there are some cases of gastric cancer with absolutely no symptoms, others with only reflex symptoms, notably where the symptoms are entirely referred to the large bowel, and finally those with only systemic symptoms—general malaise, progressive asthenia often associated with slight rise in temperature—nevertheless in most cases the symptoms, although often indefinite, are usually gastric. It is extremely wise in old age to suspect every case with gastric symptoms which cannot be satisfactorily accounted for, especially if coming, as it were, out of a clear sky, but the pity of it, in this, by far, the largest group, is that with its predilection for the silent area definite symptoms may develop so late that what we think is the first or second, is in reality the fifth act of the tragic drama.

The X-ray, fluoroscope or radiograph, is extremely helpful in diagnosis, although often of much less value in the earlier stages, but we must not forget that gumma of the stomach, perigastric adhesions, often of singularly small extent, often originating from a chronically diseased gall-bladder, a reflex spasm or traction of a ptosed, dilated stomach on a relatively fixed pylorus-duodenum, may give persistent filling defects, mistaken for cancer, while on the other hand, in certain cases of extensive cancer of the stomach, the X-ray findings are negative.

In our experience the most difficult diagnosis is that between gastric cancer and *pernicious anæmia*, *chronic gall-bladder disease* and *gumma of the stomach*. We never make a diagnosis of gastric

cancer until a Wassermann reaction has been made, although in our experience in only one-third of the cases of gastric growth with a positive Wassermann does this growth prove to be a gumma, in the other two-thirds of the cases it is simply the presence of a malignant lesion in a luetic individual

As regards treatment of gastric cancer, surgery is our only hope. We have found radium and deep X-ray therapy of absolutely no help while often it adds to the discomfort of the patient by the marked asthenia and persistent nausea which often follow the treatment. We have had no success with treatment with colloid metals such as selenium and our experience with lead has been disappointing.

But for the operation to be successful it must be performed at a relatively early stage of the disease, we say relatively early advisedly, for really early operation is impossible except in accidental cases when the abdomen has been opened for other purposes. I feel that we are probably wrong in our estimate of the length of life in gastric cancer, six months to one or, at the most, two years, for I believe that cases may in reality last three or even five years, there must be a very long symptom-free period in many cases, especially in the old, or as Freund well puts it "of cancer we see only the fifth act of the drama, the other four acts are practically unknown."

Experimental laparotomy, so safe in the hands of modern surgeons, is absolutely justifiable in suspected or even apparently very unfavorable cases, if we are prepared to perform extensive surgery, even at the greatest risk to life, if there be any chance of success, on the other hand, opening the abdomen simply to confirm a hopeless diagnosis, it seems to us, is absurd. But to increase the patient's chance of recovery is not so much the function of the surgeon, however brilliant his technic, but of the internist—for it is to him that the patient comes first, and on his keenness in suspecting early cancer, and his boldness in recommending surgery, depends the patient's chance of real cure.

Horsley has recently reported four successful operations on patients more than seventy years old and we in our Clinic now have records of between fifteen and twenty cases of gastric cancer in people of middle and mostly of later life who have successfully recovered from the operation and who were alive at a period of from six months to five years afterwards.

Hanrahan's finding, again in Finney's series, showed an operative mortality in cancer of 18.5 per cent below fifty, 22.2 per cent. over fifty, and age apparently has no effect on the subsequent history of those who survived the operation.

It is a surprising fact that in the vast majority of cases of neoplasm of the intestine an early diagnosis is rarely made, and even a late correct diagnosis is made with shocking infrequency. In a series of nine consecutive cases in the old for instance, which we saw within a period of a few months—cases with symptoms lasting from six to eighteen months—in not one had the condition been recognized. They had been diagnosed and treated as cases of chronic constipation, mucous colitis, nervous intestinal indigestion, intestinal cramp and colic, and even gastric dyspepsia, the last peculiarly interesting because just as we have in rare instances gastric cancer with only intestinal symptoms, so in certain cases, the reverse may be true, and nausea, vomiting, pyloric obstructive symptoms, and even hæmatemesis, may be the only symptoms of a cancer of sigmoid or colon. The main reason for our failure to make early or even late correct diagnosis of intestinal growths is our failure to suspect their presence, for when we remember that in only 5 per cent of the cases is the growth present in that portion of the gut obviously inaccessible to careful methods of study—the small intestine—while the other 95 per cent of the cases are in the large bowel—80 per cent in the rectum, 15 per cent in cæcum, colon and sigmoid, in the examination of which easy diagnostic methods are ours for the asking, we cannot fail to realize how much earlier and much oftener these cases should be recognized. Digital rectal examination, sigmoidoscopic study, test of the stool for occult blood on a meat-free diet, careful abdominal palpation, in a hot bath if the walls are rigid, careful X-ray study, especially fluoroscopy with the barium enema—these methods, all so simple, will give us usually our diagnosis, but are rarely used in the early stages of the disease because the condition is not suspected.

I know of no better rule than this. In all cases, but especially in the middle-aged and old, always suspect the possibility of malignancy in everyone whose intestinal habit shows a change without cause, constipation of progressive type, diarrhœa (often a false diarrhœa), alternating constipation and diarrhœa, attacks of colic or cramp which are often the earliest signs of beginning obstruction. Any

symptoms which appear *de novo* and which do not yield to simple symptomatic treatment should arouse our suspicion and should make us utilize the simple methods of study mentioned above

Surgery is the only cure, but to give surgery a fair chance of success, early diagnosis is important. But to make an early diagnosis, suspicion, *early* suspicion, as regards the significance of symptoms, often mild or banal, frequently transitory, usually regarded as of little importance and yet in reality our first warning is essential. Remember that here, as elsewhere in the abdominal cavity, early symptoms are in the main due to associated functional disturbances, especially in the motor sphere, rather than to the organic lesion itself, for our great desideratum is to make such a diagnosis before the growth has become so large as to be palpable, and before extension or metastasis has occurred. It is really relatively easy to do this in this group of cases, for as a rule growth is slow and metastasis is late. Early diagnosis and probable surgical cure is ours for the asking if we be not blind.

The older I grow and the more experienced I become the more cautious I am in advising surgical treatment unless immediate surgery is absolutely indicated in duodenal ulcer and in chronic gall-bladder disease in the old, but the more radical I am in advising operation in gastric and especially intestinal neoplasm. In the former conditions, we can often make the patient comfortable, often clinically well, by persistence in relatively simple hygienic, physical, dietetic and medicinal measures, and the proportion of absolute surgical cures, cures when six months or more time has elapsed and the patients continue symptom free, is not sufficiently great to warrant the operative risk unless the other measures absolutely fail to give relief. But in the case of cancer, there is one and only one hope at the present writing, and that is that the growth is susceptible of complete surgical removal. If we utilize every measure to make an early diagnosis possible or probable, if we are willing to take the risk, often great risk, of surgical resection, we will be rewarded by an unquestionably ever increasing proportion of cures.

CONCLUSION

I have tried to tell you in brief some of the digestive problems in old age, some are intrinsic to old age and histologically insoluble,

for a senile atrophy cannot be replaced nor can a sclerosed artery regain its elasticity Yet even in these conditions, which spell the old age of the body, much can be done by the application of simple rules of living as regards rest and exercise, with a temperate diet and as few drugs as possible For in the treatment of this form of dyspepsia in the old, the knowledge that comes from experience and common sense is of far greater value than that which comes from laboratory studies of the most exquisite perfection

Benjamin Franklin wrote—"Would'st thou enjoy a long life and healthy body and a vigorous mind and be acquainted also with the wondrous works of God, labor in the first place to bring thy appetite to reason"—and, to quote from Marcus Aurelius, "Like a mariner who has doubled the promontory, thou will'st find calm, everything stable and a waveless bay"

In Luigi Cornaro's delightful essays on *The Art of Living Long*, written in the sixteenth century and by one who after a fragile youth lived to a ripe old age by following "*La Vita Sobria*"—the simple life—writing at the age of eighty-three—he says, "Not to satiate oneself with food is the science of health" and again—"A man cannot be a perfect physician of anyone save of himself alone" At eighty-six he says, "The only mode of living that will render you secure in the hope of the long years of health consists of your adopting, at least after the age of forty, the temperate life", and at ninety-three—"Man is enabled to reach the middle of life solely through the power of youth and a young stomach, those natural gifts which have helped him in the ascent of the hill, and since old age is exactly the opposite of youth—just as disorder is the reverse of order—it becomes imperative for him to change his habits of life as regards eating and drinking, that as his early years were sensual and disorderly, the balance of them must be exactly the contrary—reasonable and orderly", while in his last essay, written at the age of ninety-five, he says, "I hope the knowledge of so great a blessing as my old age has proved to be will induce every human being to adopt this praiseworthy, orderly and temperate life, in favor of which I ceaselessly keep repeating—live, live that you may become better servants of God"

Lord Bacon wrote in his declining years—"Diet well ordered bears the greatest part in the prolongation of life"

While the gentle Addison said—"When I behold a fashionable table set out in all its magnificence, I fancy that I see gout and dropsies, fevers and lethargies, and other innumerable distempers lying in ambush among the dishes "

"Against diseases known, the strongest fence
Is the defensive virtue—abstinence "

In the great group of digestive diseases of the digestive tract met with also in other ages—though some much more common in the old—I have tried to show that in our diagnosis, our therapy, our prognosis, we must consider the age of the patient, but also that with finer methods of diagnosis, more skill in the use of diet and physical methods, and better surgical procedure, there is an ever increasing number of cures in the case of patients in the sixties and seventies, where ten or twenty years ago little would have been done to cure and only half-hearted attempts made to make them more comfortable. In the better treatment of this group of cases, in the better results obtained, praise if you will the greater skill of the clinician, the ever increasing refinement of modern laboratory methods, the improvement in surgical technic and with it the greater brilliance of the surgeon, but save a little *kudos* for the old patients themselves who refuse to become old, who scorn the stern Scythe-Bearer, and who are willing to take the same risks in the hope of reaping the same rewards as their children and their grandchildren.

POSTPONEMENT OF THE INDIVIDUAL PROCESSES OF AGING

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How often have we noticed the young child talking freely and unconsciously without any regard of the people around him, whose naive remarks fill the adult hearers often with amusement or embarrassment. A few years later this same child is shy, timid and quiet amidst its elders, feeling conscious of only two classes of society—children and the grown-ups. Do we not know by this change that the child is now conscious of his ego and for the first time begins to interpret the things he says and does in relationship to what he thinks or others think?

Soon after he knows and recognizes "I" he realizes that "I" will not continue forever. The knowledge of what death means comes to him and the first thought of it may strike terror to his little heart or he may not fully appreciate its meaning until some loved one is taken away from him forever.

During these childhood days there is frequent rebellion to parental warning and reproof which admonishes him not to do this or that. "You may get hurt, you must not eat that, you will be punished because you did that." He learns, however, with these parental aids, and sometimes after bitter and painful experiences, the many things which it is unsafe for him to do.

There are a large number of things which this animal instinct leads him to fear as dangerous, the dark, sudden noises, forcibly opening the mouth by others, and threats of, or actual, violence upon his person by older or larger individuals teach him promptly that "he who fights and runs away may live to fight another day."

The instinct for self-preservation is inherent and strengthened as each year of life goes by, remaining strong and dominant in practically every healthy mind. Our interest in old age is then based on our fundamental instinct of self-preservation, and although childhood and youth often take long chances and run great risks, yet they run not into danger when mature enough to appreciate fully the con-

sequences. The adult therefore has the desire to live as long as he can and is keenly desirous of postponing death and maintaining good health as long as may be possible

Cellular Immortality—Living tissues have been kept alive by various experiments and in some instances longer than the average duration of life of animals from which the tissue was taken. It would seem that all the essential tissues of the metazoan body are potentially immortal. Pearl, quoting from the work of Carrel, Harrison, Wilson, Leo Loeb and others, comes to the conclusion that "it is the differentiation and specialization of function of the mutually dependent aggregate of cells and tissues which constitute the metazoan body which brings about death, and not any inherent or inevitable mortal process in the individual cells themselves"

In the study of medicine one finds that diseases are caused by the introduction of poisons from without or as a result of poisons produced by one cell group whose disordered function produces materials which may injure other cell groups of the metazoan body

It has been shown that a large amount of danger to the human organism which comes from without may be prevented

An endeavor has also been made to explain the fact that a proper regimen of life diminishes to a very large extent the possibility of injury to each of the cell groups

As the individual grows older, evidence is almost always found of injury to a particular tissue composed of specialized cells and the causes of this injury are extremely difficult to ascertain.

Pathologists and teachers of normal histology frequently speak of the difficulty in obtaining a normal kidney which when cut into sections and demonstrated to a class is really proven to be normal. The instructor is usually forced to accept a kidney which he does not believe normal or is as near normal as he can obtain. The question then is raised—How much abnormality is normal? This is true of every organ of the body as almost always some departures from the normal are found. Although this may be true of the organ, it may be less true for a tissue and the specialized cells composing that tissue. There still remains a large amount of investigation to be done on the subject of the relation of disorders of one tissue to other tissues and organs. We readily recognize the important relationship between diseases of the heart, kidney and arteries but that relation-

ship is not as yet fully explained. Old age and senility are not the natural wearing out of various organs or tissues but are definitely pathological changes which may be detected at autopsy in the various organs of the body, the commonest lesion being the replacement of normal specialized cell tissue with connective tissue with the gradual diminution of the amount of normal tissue remaining, resulting in lowered and impaired functioning and finally an insufficiency which results in some type of auto-intoxication which brings about the terminating dissolution

The Value of Life—What life is, whence its source, and what its meaning, need not concern us here. We must concede the fact, however, that human life is of untold value to the individual, and that very commonly the individual is to himself the most important person in the world. The individual, however, is not completely wrapped up in self and is desirous of prolonging his life for the sake of wife, husband, offspring and family, and often for other altruistic purposes

Without human life on the earth there is no earthly planet left and as we cannot conceive of the earth without human life, let us accept it as part of the planet and appreciate as Plato shows, that human lives are interdependent on one another and that human life has value

In our modern capitalistic world life has a definite monetary value. Dublin¹ has shown that at the present time in the United States in families whose total income averages \$2,500 annually, the cost of rearing a child up to eighteen years of age is \$7,239—this cost including food, shelter, clothing, education and medical care. Making due allowance for those children who do not survive the age of eighteen, the sum is raised to \$10,000, and in these figures no sum is included for the cost of maternal care

In this financial status (a maximum income of \$2,500) a boy of eighteen has a capital value of \$29,000. In families where the maximum earnings are \$5,000 yearly, the boy at eighteen has a capital value of \$34,320.

The capital value of men in the United States is fixed by Dublin at one thousand billion dollars, and of women, at half that figure.

Our national assets other than human capital, in 1922, were fixed

¹ Dublin, Louis I., "Health and Wealth," Harpers, 1928

at \$321,000,000,000 or approximately one-fifth of the value of the human capital Nicholson, in Britain, estimated the value of human capital in the United Kingdom in 1891 as five times the value of all other capital

How Long Do We Live?—A given number of individuals at various ages, from birth onward, at each year of life die, and a life-table may be constructed by beginning with 100,000 children born, and deducting the number who will die in each succeeding year according to the existing death rates at each age group Each year we find the number still alive diminishing but with our present expectation of life these 100,000 individuals will live 51,577,502 years or the average of 57 7 years From this life-table we know that the average age at death is 57 7 and that out of 100,000 individuals

72,074	will live to be	fifty
59,639	" " " "	sixty
41,705	" " " "	seventy
15,331	" " " "	eighty
1,780	" " " "	ninety
33	" " " "	one hundred

and these last will all have died before the 107th year has ended

Do human beings live longer than 100-110 years? We hear that John Parr lived to be 152, was autopsied by William Harvey, and his remains buried in the Abbey, that Henry Jenkins lived to be 157 and Margaret Desmond lived longer There have been no similar cases reported in the last hundred years, even though the period of expectation of life has steadily lengthened Is this not because we have more accurate knowledge of individuals by birth registration, identification and so on? Young² gives clearly the various reasons for disbelieving these cases of alleged longevity

It is reported that in Bulgaria and Rumania there are more centenarians in proportion to the total population than there are in this country This is ascribed to the greater use of milk, especially that type known as yahourth, or as we know it, milk with the Bulgarian bacillus added to it

There may be more centenarians in these countries but the statements should not be accepted until more definite and careful analysis has been made of the records

² Young, T E, "On Centenarians," C & E Layton, London, 1899

In 1920 the United States census reported 4,267 centenarians, 69 per cent of whom were negroes, and Dublin notes that as our census machinery improves, the proportion of reported centenarians becomes smaller

*Average Age at Death*³—In 1901 the average expectation of life in the United States (registration area) was 49 24 years, and in 1926, 57 74 years. This marked change does not mean necessarily increasing longevity but a great saving of life in the lower age groups and a great increase in the number who reach maturity and 65 years, the threshold of old age. Under the conditions existing in 1901, out of every 100,000 individuals born, 40,911 will reach the age of 65, but under present conditions there will be nearly 52,000 reaching the age of 65. The life-tables show, however, practically no gain after the age of 65. At that age, in 1901, the expectation of life was 11 86 years, and in 1920, 11 97 years. Now it is probably a little over 12 years. That is to say, that notwithstanding the great increase in the average age at death, the far larger number of persons who reach the age of 65, have little chance of living to a ripe old age.

Causes for These Increases—Infants have a far greater chance of growing up and reaching maturity in this country than they had 25 years ago. This is due to the intelligence and financial ability of the masses of the people to apply hygienic measures, to secure sufficient and proper food, clothing and shelter. It is also due to the application of well-known public health measures for the control and prevention of disease, and the protection of the public by the maintenance of safe water, milk and food supplies by the public health authorities.

Can Disease Be Further Prevented?—Irving Fisher⁴ sent a list of some ninety diseases to a number of prominent physicians asking them to indicate the percentage of deaths from these diseases which could be prevented. Forsyth analyzed the replies and prepared a life-table showing the expectation of life if the diseases were prevented in accordance with the ratio indicated, and found that on an average, 2 years and 245 days could be added to the span of life (Pearl's "Biology of Death," chart 16b, pp 164-165). These tables

³ Dublin, *loc cit*

⁴ Fisher, Irving, Quoted by C. H. Forsyth, *Quart Pub Am Stat Assoc* "Biology of Death," Pearl, Lippincott, 1922

were based on the mortality rates of 1900-1910, but if applied now, would undoubtedly show a greater expectation of life. The expectation of life in 1900 was 49.4 years and if the various possible savings of life suggested by the physicians were obtained, the expectation would be 62.11.

Some of the biologists expressed themselves as being more favorably inclined to selecting long-lived parents than to spend so much effort to prevent disease. Alex. G. Bell's⁵ study of the Hyde family shows that when both parents lived to be over 80, the average duration of life of the children was 52.7 years and when both parents died under the age of 60, the average duration of life was 32.8 years.

Pearl⁶ comments on the work of Fisher and Forsyth and compares the added longevity of children of long-lived parents in the Hyde family with the results that might be obtained by applying further disease-preventing measures. He concludes that "the resulting increase in expectation of life falls seven years short of what might reasonably be expected to follow the selection of only one generation of ancestry (the parental) for longevity."

The children of the long-lived parents did live on the average 20 years longer than the children of shorter-lived parents, but in 1926 the life-table shows the expectation of life to be 57.7 years, and is now probably over 58, which is 5 years longer expectation than the children of the long-lived parents actually lived. We may say now that, irrespective of parental age, a child born today has a better expectation of life than children of long-lived parents during the period covered by the Hyde family study.

Fortunately, a similar study has been made by Dublin who, however, has not selected a theoretical death rate resulting from a possible diminution based on medical opinion, but a hypothetical life-table based largely on *actual* death rates now occurring in various parts of this country and in countries abroad.

This hypothetical table reveals the possibility of an expectation of life of 64.7 years in this country, and it is more than a possibility. It is very probable that we shall see death rates lowered and life prolonged and a constantly increasing proportion of the population in the older age groups from 60 years onward.

⁵ Bell, Alexander Graham, "Hyde Genealogy," Judd & Detweiler, Wash., 1918.

⁶ Pearl, Raymond, "Biology of Death," Lippincott, 1922.

The forces that have been at work in adding to the average length of life are various and cannot be ascribed to any one factor

Biologists, biometricians and statisticians have proved to their own satisfaction that public health measures have played but a small part in reducing mortality. When poverty has been given as a cause of high mortality, this argument is refuted. For example, Pearl devotes an entire chapter to show that with the exception of malaria and yellow fever control, the death rates in those diseases which have been vigorously attacked by public and voluntary agencies and those which have had little or no attention, have diminished in the same ratio in both groups. He shows that between the years 1900-1918 tuberculosis of the lungs, typhoid fever, diphtheria and croup, and dysentery, have all diminished steadily, and that they have been under continued attack. He then selects four other causes of death upon which no direct attempt at control has been made. These are bronchitis (acute and chronic), paralysis without specified cause, purulent infection and septicæmia, and softening of the brain. He shows that mortality from these four conditions has diminished at about the same rate as the four so-called controlled diseases. In England and Australia, bronchitis is regularly accepted as the cause of death and there are a larger number of deaths from this cause than from pulmonary tuberculosis. In this country for a great many years the census bureau has made further inquiry on every death reported as bronchitis and has been placing regularly a large number so reported in another category. Bronchitis as a cause of death unexplained has not been accepted in New York City for nearly twenty years as bronchitis that causes death is usually coupled with emphysemæ, asthma, or is secondary to cardiac and other pathological conditions. It would, therefore, seem that bronchitis as a cause of death would readily diminish in this country due simply to improved registration. Paralysis without specific cause is in a very similar situation. The modern registrar of vital statistics in each city does not accept this as a cause of death without explanation. Softening of the brain is a secondary condition and is being more and more classified under treatment of arteriosclerosis, cerebral hemorrhage or thrombosis, or embolism, or secondary to syphilis. From these three causes therefore it would seem to be quite evident that without any endeavor to prevent these diseases, but simply by more accurate

methods of diagnosis and registration, there would be naturally a steady decline in the mortality from these causes. This leaves purulent infection and septicæmia, which would be accounted for by a constant improvement in surgical methods and cleanliness.

Poverty and Longevity—Hersch shows that there is a higher death rate in the poorer districts of Paris than in the well-to-do districts. Some of the poorer districts have a mortality double that of the richer districts.

Stevenson,⁷ Registrar-General for England, shows a smaller difference in London that the poorest group have a mortality of 30 per cent higher than the richest.

Pearl raises the question as to whether there are not biological differences in the population and states that the stillbirth rate is a very sensitive index of hereditary, biological constitution. He finds that the stillbirth rate is about the same in all groups in Paris, a little higher amongst the well-to-do group. He sees no argument in the possibility of the death rate among the rich becoming higher if they become poor, and conversely.

If Pearl is right and the stillbirth rate is a good index of constitution, there is no reason biologically why the mortality rates should not be the same in the rich and poor.

Drolet has shown that there is a marked difference in the death rates from tuberculosis in different sections of New York City, Manhattan especially showing marked contrasts, the wealthier sections have the lowest mortality rates, and the poorer sections, the highest.

Guilfooy has prepared a series of maps of Manhattan giving the mortality rate, all causes, and for various diseases. These maps are not correlated in any way, but they show that in general, death rates are higher among the poorer sections of Manhattan and lower among the wealthier sections.

When studies are made of mortality from specific causes correlated with family income, there is found almost always a definite relationship—the poorer the family, the higher the specific death rate.

This is not true, however, of diseases which occur in the later periods of life. Hence, one is led to assume that there is a larger proportion of older persons among the well-to-do than among the

⁷ Stevenson, T. H. C., quoted by Pearl.

poor So, notwithstanding the arguments to the contrary, there is a definite relationship between poverty and mortality

Housing—There are a number of individuals who have shown that there is a definite relationship between the number of persons living in one room and the death rate It has been proved for tuberculosis that the larger the number of persons living in one room, in a family where there is a case of tuberculosis, the higher the death rate

Poor housing, filthy tenements and slum areas are therefore held responsible for a high death rate

Public Health Measures—Robinson Crusoe had no need of a health department, for the original idea of public health activity was to suppress epidemics As scientific knowledge of disease was acquired, the idea of suppression gave way to that of prevention

It will not be possible to do more than point out the fact that some diseases can readily be prevented by measures readily applied, as for example vaccination against smallpox, if fairly universal, prevents the disease

Proper filtration or purification of water supplies almost wholly prevents typhoid fever and also cholera to a great extent. Draining marshes, oiling stagnant water and screening houses diminishes the incidence of malaria to a minimum and, in some localities, to almost complete disappearance The same is true of yellow fever

Other communicable diseases as scarlet fever, measles, diphtheria and tuberculosis are not so readily controlled or prevented It is the individual who must be reached first by physician and then by health authority, but the physician does not come until sent for and often arrives too late The reduction of incidence and mortality from these diseases has been constant in this country during the past quarter of a century It is believed that no one cause has operated in the reduction but public health measures, and in particular, early isolation or quarantine has been perhaps the most important measure

Better housing, permitting often a single room to an individual, more cleanliness, improved methods of the disposal of human and other wastes, and the more effective control of the milk supplies of our cities, especially by effective pasteurization, have all acted favorably

A factor often overlooked by public and voluntary agency staffs is the marked improvement in the practice of medicine. Earlier

diagnosis, better treatment and competent nursing have saved the lives of thousands, or in tuberculosis, postponed death for almost an indefinite period, but more than that have prevented the infection from attacking other members of the family in countless instances

In more recent years many health departments have undertaken activities which relate to individual health and endeavor by physical examination and advice to aid the individual in preventing the onset of diseases which are not a menace to other persons in the community. This field is largely educational and had its inception in the infant welfare clinic and the results are more difficult to measure

Meyer⁸ has shown that the baby clinic alone cares for such a small proportion of the total number of infants that its influence is not very large. Physicians have scoffed at the baby clinic, one medical society going so far as to vote the infant welfare clinic a menace to public health. It has been proved over and over again that a very large proportion of mothers who take their infants to such a clinic will not seek medical advice, and that the results obtained in the clinic are far better than among infants of the same walk of life whose mothers are not advised at all

Occupations—There are rarely any definitely determined factors in the selection of an occupation. Youth appreciates or is forced to accept the fact that one must work for a living and a livelihood is sought usually in the occupation which is nearest at hand, opportune, or available. Parents and the youth about to engage in an occupation do not know that the choice of an occupation is determined unconsciously by the intelligence and physique of the individual and by his mental outlook on life and that of his parents

One does not hear often of an occupation being undertaken or shunned because it is dangerous, for a youth is rather more apt to court danger and is usually self-confident even though aware of possible risks and fully expects to live longer than anyone else no matter what the hazards of his occupation may be. The general public does not usually know that one occupation is more hazardous than another for there are many individuals in almost every occupation of mature age, many of whom may be classified as old

⁸ Meyer, Ernst C, "Infant Mortality in N Y C" A study of results accomplished by infant life saving agencies N Y, Rock. Found., 1920 *Inter Hlth Bd Pub* 10

When statistics are compiled which include thousands of individuals, it soon becomes obvious that industry requiring either physical labor or the operation of machinery entails more risks, a greater number of accidents and a higher death rate and shorter duration of life than are found in the clerical and professional classes

In industry, the risks are primarily from dust, gases and accidents and the various factors which are found in factory work such as poor ventilation, insanitary conditions, long distances from home to factory, posture and hours of work.

On the other hand, the professional and clerical class are frequently confined in places just as insanitary as many factories, often subject to press of work with overtime and all the stress which goes with our modern life, including the risks of travelling and climate. The risks of travelling and climate are sometimes great in the professional and business field for many individuals are situated for long periods of time in climates where they are susceptible to the risk of infection from malaria, typhoid or tropical diseases and frequently to unusual temptations, exaggerated as a result of the climate or lack of comradeship

It is difficult to find definite figures as to the average duration of life of individuals occupied in different fields of human endeavor, but one remarkable study was published by the Registrar-General⁹ of England and Wales giving the mortality between the ages of 25 to 65 for all males occupied in industry in those countries during the years 1910, 1911 and 1912. A figure of comparative mortality was determined which, although it has no significance in itself, has some relative importance as if the figures were given in terms of death rates. A few have been selected at random which show marked differences in the comparative mortality between different groups

Printers, compositors	393
Clergymen, etc	443
Coal Miners	645
Physicians	693
Painters	805
Stonemasons	951
Potters	1196
Lead Miners	1185
Merchant Seamen	1485
Barmen	1724
General Laborers	2301

⁹ Stevenson, T. H. C., Registrar General's 75th Annual Report

The risks and dangers of industry have been well recognized in this country and it is unusual to find at the present time a large industry which has not established some type of health service for its employees. This health or medical service has reduced the labor turnover, the cost of medical care, the number of days lost in the industry and the cost of it has been placed upon the ultimate consumer of the product of that industry where it probably belongs. Industries employing a small number of individuals find it well nigh impossible to carry the overhead cost of a medical service and need guidance and assistance from voluntary agencies or governments to safeguard the health of their employees.

Health Education—How much influence does the continued health propaganda have on the lives of our people? Impossible to estimate but undoubtedly it makes a definite impression, particularly when made available to school children and the young adult.

In a nation of advertisers we accept statements that are widely heralded as true, and the health literature which is distributed is far more accurate and free from exaggeration than that found in the commercial field.

A very prominent citizen told of the difficulty in persuading his children to sleep with windows open and to brush their teeth regularly. He took them to a health exhibit years ago and they promptly accepted the precepts learned there, and have already passed them on to their children. Is this worth while? Who can tell of the number of similar instances? Can one measure health advertising by the amount of the sales of the commodity? Or can one measure the causes of the steadily diminishing morbidity and mortality, for the affair is far too complex?

Applied Intelligence—Compulsory education has been fairly universal in this country for about fifty years. We treasure it as a right and a necessity and have found it furnished to all whether they pay taxes or not. Compulsory education may not mean that every youth who finished the primary grades or graduates from high school or college, is educated, but at least he is informed to a certain extent and is able to read and in many cases can still learn and form fairly wise judgments from data presented to him. He learns much of hygiene unconsciously by accepting readily the joys of a bath tub, the

comfort of a modern system of water carriage sewage disposal, quite in contrast to the uninformed and often illiterate peasant who uses one for a coal bin and must be taught how to use the other

Our young citizen's schooling has taught him to accept cleanliness for himself if not as yet for his community. He has learned a great deal about foods, clothing, shelter and many other things necessary for health.

Why Do We Grow Older?—It is because our people have acquired a better knowledge of child care, an intelligence which enables us to care for our own bodies and our children's in a hygienic way, and because of the improvement in our economic situation, the vast majority of people have the means to provide themselves with food, shelter and clothing. This adequate standard of living, although not yet universal in this country, is still far more general than exists in any other country today, and probably a better condition exists here than ever existed in this or any other country at any time.

This intelligence and standard of living alone would not suffice were it not for the improvement in our health departments and the widespread protection of our water, milk and food supplies, pretty generally guaranteeing their safety and freedom from material carrying disease. Nor would the health department alone suffice were it not for the more and more efficient effort of the health field worker, the practicing physician and his aid and ally, the nurse.

Personal Hygiene—In infancy and childhood, health habits are readily acquired and infants and children must be trained by the mother or nurse. Feeding must be given at regular hours, of proper quality and amount.

Most babies are born well and if properly cared for may be kept well. The modern pediatricist has produced wonderful results in this direction and a great deal of our reduction in infant and child mortality has been due to the improved practice of medicine in childhood.

As soon as the child is old enough he should have some instruction on how to keep well. This should not be formal in character but with simple rules of health both at home and at school the young child soon learns to wash his hands before meals and after visiting the toilet, to use a handkerchief, to eat slowly and moderately, to sleep

with windows open, to wear overshoes on wet days, and so on. A great deal can be learned also in training the child to acquire proper mental habits which is a matter of great importance to physical health. Physical exercise does not often have to be urged upon a child but more often he should be guarded against overdoing it.

All the proper rules of health, every precaution to keep a well child well, will be of no avail if the public water supply is polluted, milk supplies impure, health department precautions against communicable disease ineffective, poverty restricting food and clothing and size of living quarters and medical practice of low standard.

Youth has its dangers, particularly at the time of puberty, risk of accident becomes more acute and many physical defects become noticeable. During this period the child should be regularly examined so that defects may be detected and corrective measures instituted.

In certain families an annual physical examination is hardly necessary for very often the parents notice promptly the slight squint, a droop of the shoulder, a change in gait, the open mouth while breathing, shortness of breath, trifling skin disorders and muscular twitchings. In fact almost any departure from the normal is noted and medical or dental advice is sought.

In other families, unfortunately a large number, a regular physical examination will reveal physical defects or abnormal conditions needing treatment but no amount of argument convinces the parents of the desirability of treatment, even in serious conditions.

There are individuals, even trained physicians, who have a certain authority from their writings, who decry the value of dietary and other restrictions. Clendening¹⁰ states that "happy as I should be to follow dietary and ethical restrictions if I were convinced of their validity, an impartial examination of all the means yet proposed to prevent death or lengthen life leaves me with the conviction that nothing anybody does to himself after he is born makes more than a few hours' difference at the most." This statement in a book, entitled "The Human Body," which is a very clearly written and useful book, may do a great deal of harm, as it expresses the opinion of the author very forcibly. The statement, however, is contrary to all human experience, and even the biologists and geneticists prove

¹⁰ Clendening, Logan, "The Human Body" New York, Knopf, 1927

that many of the lower species of animal life require certain specific diets in order to maintain life. No intelligent mother would agree with the author of the book, nor would a physician countenance such a statement in regard to children. It is true, however, that certain individuals may survive the abuse of almost any body function.

Adult Life—The individual arrived at his majority and independence, is very prone to do very much what he likes in regard to his personal habits, is apt to over-indulge in eating, drinking and in exercise, frequently taking too much exercise and too little sleep, overworking or under-resting and burning the candle at both ends. As middle age approaches one's tastes moderate, experience teaches him to alter his habits, marriage sobers him, responsibilities compel him to lead a more regular life and he learns the importance of keeping fit.

Conditions Affecting Health and Longevity—The human body consists of many systems and organs and tissues of different kinds, each of which react on the other. Many of these tissues and organs are susceptible to a particular injury if poisons are introduced from without.

We know the effect of certain bacteria on the heart valves, the lung tissue, nervous tissue and so on. We also know the effect of metallic poisons on many of the organs, particularly the liver and kidney and nervous system. We have learned that by the observation of many public health measures and the application of intelligence, many diseases and conditions will be prevented. We need food and drink, rest, sleep, air and shelter to maintain life. Although many theories and opinions have been given and volumes written on the subject, there is no definite specific regimen that one can lay down for every adult.

We do know that underfeeding results in malnutrition and a train of disorders may ensue if certain dietary factors are lacking. Scurvy, rickets, and beri beri are dietetic deficiency diseases and death may ensue from these conditions. It is probably true that more people suffer or die from underfeeding than from overeating if one considers the entire population of the world. There are some who believe that 20 or even 30 per cent of school children are undernourished (W R P Emerson and Wood) but in the far larger proportion of these children, undernourishment is often synonymous with

underweight and the cause is frequently a physical one and not due to the lack of sufficient food supply, though often due to an improper diet. The bountiful food supply in this country and the relatively high wages obtained by nearly all classes of society make overfeeding a far too frequent habit. This frequently results in obesity though occasionally one may steadily gain weight on a very limited diet from faulty metabolism. It may be stated very definitely that persons who are overweight—those who weigh 10 per cent or more than the average for their years and height, do not live as long as the average. These individuals do not die of digestive disturbances as a rule but of cardiac, renal and arterial disease, or acute respiratory conditions.

Many persons are faddists in regard to diet, some are vegetarians, some will not eat this or that on account of some whim or fantasy. A great many persons are asked on their ninetieth or one-hundredth birthdays, to give the reasons why, in their judgment, they have been able to live so long. In practically every instance, a limited and carefully selected diet is given as the cause. Some ascribe the restricted diet alone as the cause of longevity. Cornaro,¹¹ the Venetian, who lived to be a hundred and two, limited his food to twelve ounces daily, consisting of bread, soup or light broth with egg, or other similar dish, veal, kidney and mutton, fowls and birds and salt and fresh water fish. Wine also was limited to fourteen ounces daily. His friends and family, noticing his leanness when he was seventy-eight, urged him to eat more and he increased his daily allowance to fourteen ounces of food and sixteen ounces of wine. He soon became melancholy, suffered from pains in his side and fevers and then reduced his dietary to his former allowance. Several of his maxims are worth remembering. "Not to satiate one's self with food is the science of health." "Whoever wishes to eat much must eat little." "The food from which a man abstains, after he has eaten heartily, is of more benefit to him than that which he has eaten."

We know that the amount of food consumed should vary with the amount of muscular work performed and the size and weight of the individual.

¹¹ Cornaro, Luigi, "The Art of Living Long," William F. Butler, Milwaukee, 1923.

Is it not clear that as old age approaches, less and less muscular work is done, and therefore much less food is needed?

Further, there is ample evidence to show that older people cannot stand the gastronomic feats of youth or middle life. How can one tell whether he eats too much? First, adults who are gaining weight are obviously eating too much. Then it is true that many persons who keep an even weight often eat more than they need and if they reduced their diet they would still maintain their weight. The only sure way is to eat as little as one can and maintain his weight which should be the average for height and age. If one eats three meals a day it is a safe rule to leave the table having still a desire to eat more. One can do more, weigh and measure all his food and estimate the number of calories needed for him and also the relative amounts of protein, carbohydrates and fat that he should consume, determining the necessary vitamins to take. If this is done without medical advice and supervision there is a good chance of the individual's becoming "hipped" on himself and a nuisance and a bore to himself, family and friends. Water or foods in liquid form which contain a large amount of water are essential for body health. The amount of water required varies with the size of the individual and the amount of perspiration which takes place and also with the amount of liquid foods taken which are mainly composed of water.

A good many writers have recommended a very high amount of milk and water, as a daily necessity for children, forgetting sometimes that the water in the milk is almost all the water that is needed for the daily consumption.

In older people large amounts of food are not as readily handled as when all of the organs are sound in earlier life. It occasionally happens that undue strain will be placed upon the heart and kidney functions, resulting in œdema, which may be relieved primarily by diminishing the amount of liquid.

In many countries it has been the custom from time immemorial for a large majority of the adult population to take as part of their liquid a certain amount of wine or beer or diluted spirits daily. There have been many arguments for and against the use of alcoholic beverages and there are those who believe that alcohol in any amount is a poison and consequently should not be consumed at all. There

are others who believe that alcohol replaces the need of a certain amount of food and that a small amount of it, less than an ounce a day, in diluted form, is useful especially for older people. There is no question but that many persons live to a ripe old age even after they have consumed regularly a half ounce to an ounce and a half of alcohol daily. (It has already been noted that Cornaro consumed daily fourteen ounces of wine which presumably contained an ounce of alcohol.)

On the other hand there are many persons who believe implicitly that those who take one glass of beer or wine or spirits, will steadily increase their dose and become "chronic alcoholics" to the destruction of themselves and their families, and unfortunately this is true in a small number of cases, and so true in this country that it has resulted in very drastic laws which aim to prevent the consumption of alcohol in any form except for medicinal or sacramental purposes.

Sleep and Rest—There is an old adage that a man should sleep eight hours, a child nine and a fool ten. To determine the actual amount needed is a task which science can hardly perform, and we fall back upon human experience and human desire.

If an adult slept only four hours of the twenty-four, we should feel that there was something wrong with him. We know that the child needs more and the adult, less, that many adults are not fit without eight or nine hours, and that many keep in good condition indefinitely with five or six. Sleep implies rest and we have come to a situation of accepting eight hours as a sufficient time daily for work. This has resulted as a concomitant of an economic development and does not mean we need eight hours for washing, dressing, eating and for leisure.

Continued overwork and lack of rest and sleep will injure the human economy and occupations which require long hours of labor—physical or mental or both—will show higher death rates than those which have shorter and less laborious hours.

Exercise—The economic development of this country has also produced a very large professional and clerical class who are needed primarily in desk work and who have relatively little opportunity for exercise. Many physicians recommend to this class of individual that a walk of at least three miles should be taken daily or its equiva-

lent, and recommend to others various types of physical exercises which may be taken in one's room. Many of these physicians who give these prescriptions as to exercise so glibly, do not apply it to themselves, walking only about as far as is necessary to enter their cars and to get out again to enter a patient's house. If many doctors do not take regular exercise themselves one must know from this that it is a prescription onerous and difficult to carry out.

There are many individuals who feel that this lack of exercise might be counteracted by a vigorous amount of exercise on Saturdays, Sundays and holidays, but it is quite likely that regular daily exercise in limited amounts is better for the general muscular tone of the body than lethargy during the week and over-exertion at the end of the week.

A question has been raised recently as to whether it is advisable for a youth to undertake vigorous exercise during the entire year. There are a certain number of young men who, during their school and college days, play vigorously at various games, some playing football, hockey, baseball or running, and so being occupied at strenuous physical exercise daily throughout nine or ten months of the year.

There have been a few studies and a number of opinions expressed on this subject. Dublin¹² has shown that boys who have played baseball for a number of years are not as long-lived as those who do indulge in the sport while at college. Others have shown that members of college crews did not live as long as non-athletes. A number of college class secretaries have made a study of deaths in their classes fifty years after graduation, and have noted that the quiet, studious boy lived longer than the athlete.

From the evidence so far submitted it does not seem possible to ascribe over-indulgence in exercise as the only cause. It would seem probable that boys who are athletes and who play vigorously at football, baseball, etc., are individuals of the more venturesome type, who may take greater risks with their bodies and are less cautious in regard to their daily hygiene than the scholarly type, who leads a quiet and more or less sheltered existence.

¹² Dublin, Louis I, "Longevity of College Athletes" *Harper's Monthly Magazine*, July, 1928

Glandular Secretions—Brown-Séquard¹³ first reported to the French Academy of Medicine the results of tests made upon himself with animal extracts. He believed that by the administration of testicular extract made from animals he had added to his strength and physical and mental vigor.

Not many years elapsed before one began to hear of the use of thyroid extract and adrenal extract and experimentation with their use gave a clue to some of the functions of the thyroid, adrenal and suprarenal.

Voronoff¹⁴ more recently has reawakened a great interest in the entire subject of glandular therapy by transplanting segments of the testicle or ovary of vigorous animals in animals which were old and found that when the graft had taken there was a marked improvement in physical condition and a practical rejuvenation process had taken place.

The duration of improvement, however, does not appear to be permanent and at present does not appear to be the type of operation which is either readily feasible or acceptable for many of the population.

Steinach has modified the operation in males by simply tying off the duct which carries the seminal fluid from the testicle to the prostate, bringing about an absorption into the general circulation of that part of the seminal fluid which acts as a stimulant to physical and mental vigor.

These are procedures which cannot as yet be recommended but which will probably be tried and which may result in a more widespread use. On the other hand, one would look more hopefully to the possibility of discovering the exact nature of the substances produced by the ductless glands and developing their manufacture so as to make them available for therapeutic purposes.

Leonard Williams in his book entitled, "Middle Age and Old Age" has indicated the function of the various internal secretions and the possibilities of therapeutic use and there are many other articles which give more details.

¹³ Brown Sequard, "Report on Effects Produced by Injection of Testicular Extract" Communication made to Société de Biologie, Paris, June, 1889

¹⁴ Voronoff, Serge, Life of, Dutton & Co, N Y, 1920

The entire subject offers a fascinating field for study and research which is yet in its infancy

Elixir of Life—As children we were brought up on the story of Ponce de León's search for the Fountain of Youth and prior to that time and ever since, man is always ready to succumb to a new fad or fancy or new fashion of treatment which offers to him either a universal cure-all or the sovereign essence of life. We have seen pass in review scores of methods of living and hundreds of treatments of various kinds which were sure to make one live almost forever

Among the earliest was an American, Perkins, who was to increase longevity and cure all diseases by wearing metal plates in the shoes, which were discarded within a few years

Kneipp in Germany had a large following with thousands of people walking barefoot in the dewy grass before breakfast, which was expected to put the body into a more healthful condition

A highly scientific effort was made by Metchnikoff¹⁵ to determine the influence of the large intestine on health and longevity. He believed in the fermentation taking place in the intestine that its products were absorbed into the blood system and caused a continued auto-intoxication with harmful results to the body. Finding the intestines regularly filled with innumerable bacteria of various types, he endeavored to ascertain a method of disinfecting the intestines to try to have it nearly sterile. He urged strongly the use of milk boiled and always eating cooked food and found that the peasants of Bulgaria seemed to live a long time from the continued use of milk which was acidulated and known as *yahourth* and from this particular milk he obtained the Bulgarian bacillus. For years thousands of people drank milk with the Bulgarian bacillus in it or assumed to be in it (for many cultures and tablets sold probably did not contain as many of these bacilli as advertised). This system has gradually passed into oblivion.

Horace Fletcher,¹⁶ a prominent layman, recommended the slow and thorough mastication of food and a marked diminution of its quantity. For a number of years he had a considerable following—so much so that his system was known as “fletcherizing.” Fletcher

¹⁵ Metchnikoff, Elie, “On Prolongation of Life,” Putnam, 1928

¹⁶ Fletcher, Horace, “A B Z of Nutrition.”

had a scientific train of mind and persuaded Chittenden to follow out a number of experiments and apparently proved that instead of a large man requiring 2500 to 3000 calories for every twenty-four hours, one could get along on 1600 calories with less than 50 grams of albumin every twenty-four hours

Conclusion —An effort has been made to show that in order to postpone the individual process of aging, one must first pass through the perils of infancy and childhood and reach maturity and the threshold of old age, 65, to consider how one really may live in order to grow old. In our modern civilized communities the average expectation of life has gradually increased and this has been possible as a result of properly applied public health measures and an increased amount of information on health matters among the general public. The distribution of this information and its intelligent use is only possible where economic progress has been sufficiently great to permit a reasonable amount of space for living quarters, adequate and proper food and clothing and all that goes to make up a decent standard of living. It is also evident that these measures alone will not suffice unless the individual may develop sufficient character and self-control to lead a life of moderation in physical exercise, mental work, diet, rest, the amount of time devoted to each divided so that there is no lack or abuse of any of these factors.

Diagnosis and Treatment

THE RONTGENOLOGICAL EXAMINATION OF THE APPENDIX

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THE title of this paper does not refer to the acute appendix. For obvious reasons the diagnosis of acute appendicitis does not fall within the scope of the rontgenologist. A great deal can be learned, however, about the non-acute appendix, by a systematic rontgenological examination. In a large percentage of cases in which a barium meal has been administered, barium enters the appendix and can be demonstrated on the fluoroscopic screen and by rontgenograms. Up until six years ago the writer was able to visualize the appendix so seldom, that no special study of it was possible. With improvements in apparatus at about this time, came improvements in technic, and we now visualize the appendix in about 90 per cent of cases in which it has not been removed.

The technic used for the past five years is as follows. The patient is told to take a soapsuds enema on getting up, and to eat no breakfast. The examination is begun as early in the forenoon as possible. The single barium meal is universally used in all of my gastro-intestinal work for two reasons. In the first place, so many patients suffering with gastro-intestinal trouble find it so hard to take and retain even one barium meal, that to ask them to repeat the procedure six hours later seems an unnecessary hardship. Secondly, I find it less confusing to watch the progress of one opaque meal through the gastro-intestinal tract, than two.

The apparatus employed is a so-called "tube-tilt" table, a combined fluoroscopic and rontgenographic unit, which can be used in any position from vertical to Trendelenburg.

The opaque meal is given with the patient standing back of

the vertical fluoroscope Inasmuch as this paper is dealing only with the appendix, we will simply mention, in passing, that the examination of the œsophagus, stomach, and duodenum is begun during, and immediately after, the ingestion of this single barium meal Screen examinations and rontgenograms are made in the vertical, horizontal and Trendelenburg positions After completion of this part of the work, the patient leaves, to return in six hours No special restrictions in diet are enforced from this time until completion of the examination All medication, however, is suspended

It is at the six-hour examination that our work in studying the appendix begins At this time the stomach should be empty of barium, the opaque meal usually occupying the lower ileum, ascending and transverse colon The patient is examined first in the recumbent position, the rays coming upward from below the table, and the fluoroscopic screen, or film cassette, supported above the patient's abdomen The screen is moved until its centre is immediately over the cœcum The diaphragm is shut down until an area about 8 x 10 inches is illuminated The cœcum is then carefully palpated, the coils of the ileum are pushed aside, and a search made for the appendix It is often necessary to drop the head of the table to the Trendelenburg position, to allow coils of ileum to get out of the field of examination, by gravity As a very general rule the appendix can be visualized at this six-hour examination, although occasionally it is not filled until some hours later If the appendix passes upward and is retrocœcal, it will at first be invisible, but by pushing the cœcum aside and rotating it slightly, it can usually be brought into view If it again disappears behind the cœcum after the examining hand is removed, an aluminum hemisphere is substituted for the hand, a cassette is placed above this aluminum cup, pressure is applied by clamping down the fluoroscopic screen, the current is advanced, and a rontgenogram is made

When the six-hour examination is completed, the patient again leaves, to return at the end of twenty-four hours

The twenty-four hour examination is likewise begun in the recumbent position The cœcum should be empty at this time, but as a matter of fact we find it still filled in a large percentage of cases As a rule it is during the twenty-four-hour examination that we obtain the most information concerning the appendix The coils

of the ileum are now empty of barium and do not obscure the field. It is often again necessary to make pressure with an aluminum cup during the exposure, if the appendix shows a tendency to disappear behind the cæcum. Here, again, the ability to shoot the rays upward, with the table in the Trendelenburg position, often determines the difference between success and failure.

An important point which I wish to mention at this time is, that in visualizing the appendix it makes a great deal of difference whether the patient lies on the abdomen, with the film cassette underneath, and the rays coming downward from above, or, whether these relationships are reversed, and he lies on his back, with the film cassette above the abdomen, and the rays coming upward from below the table. With the former method, the increase in intra-abdominal tension crowds other barium-filled structures in front of, or behind, the appendix, and hides it from view. With the latter method this is not the case. In cases where it was quite easy to visualize the appendix in the recumbent position, I have tried the experiment of turning the patient over in the prone position, with the film cassette beneath and the rays coming downward from above, and in nearly every case the appendix was completely hidden.

In fluoroscopy of the appendix, it is interesting to note that where pressure tenderness exists, it does not bear a fixed relationship to McBurney's point, but is practically always immediately over the appendix, no matter where the appendix is located. There is often three or four inches' difference in the point of pressure tenderness in an examination made first in the vertical and then in the Trendelenburg position, this variation corresponding exactly to the elevation of the level of the cæcum with change in position of the patient. In view of the absence of sensory nerves in the appendix this may possibly be explained by the fact that in making pressure over the cæcum a small amount of gas is forced into the appendix. In two cases which I recall, there was such extreme ptosis of the cæcum that the appendix was seen in the left lower quadrant, and the point of pressure tenderness was immediately over it, no tenderness whatever existing in the right lower quadrant. In cases where the cæcum was fixed, the tender point was likewise fixed.

Having visualized and studied the appendix by the combined

FIG. 1



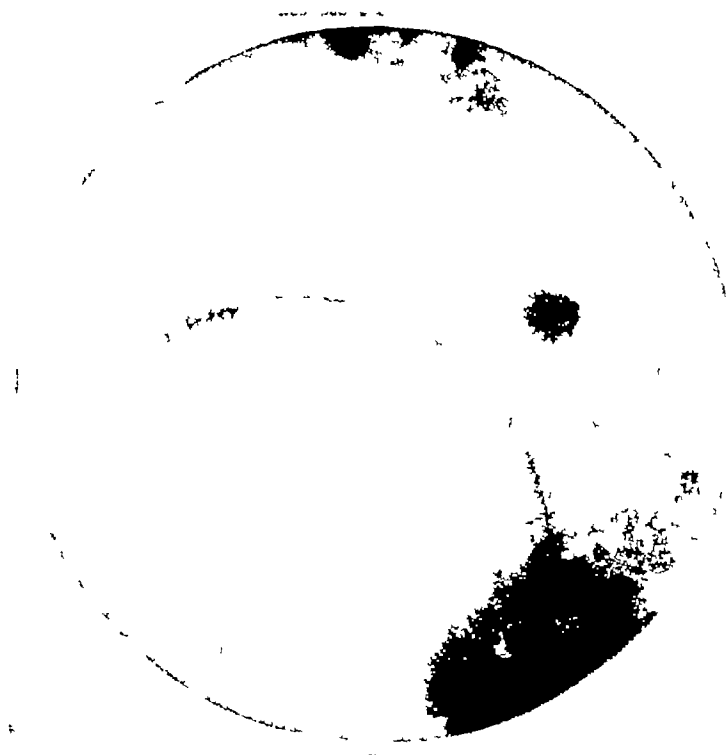
Retrocaecal appendix bound down by adhesions pressure made with aluminum cup to force appendix away from caecum while roentgenogram was being made

FIG 2



Retrocecal appendix bound down by adhesions

FIG 3



Adhesions holding tip of appendix in a fixed position

FIG 4



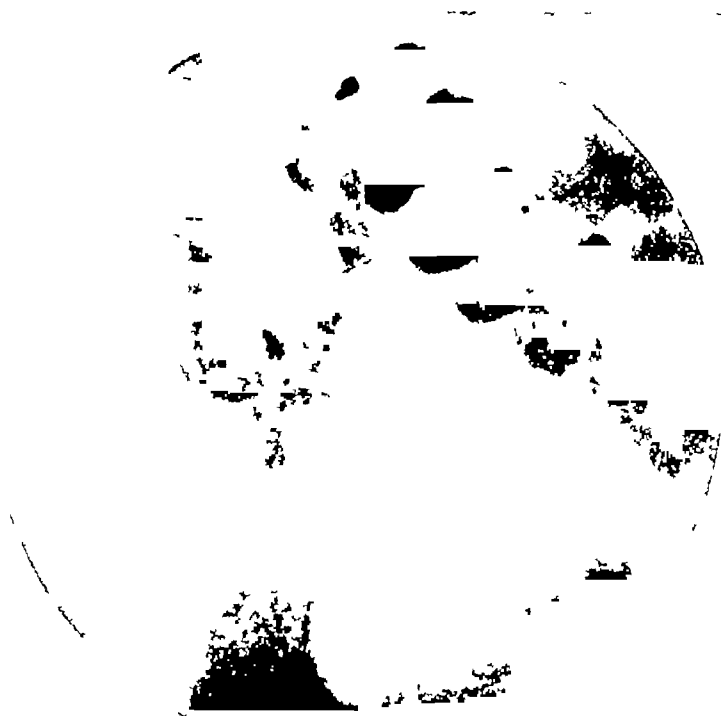
Tip of appendix adherent to sigmoid

FIG. 5



Kinked appendix Could not be straightened out under fluoroscope

FIG 6



Linked appendix. Could not be straightened out under fluoroscope

FIG 7



Appendix showing several loops which could not be straightened out under fluoroscope

FIG 8



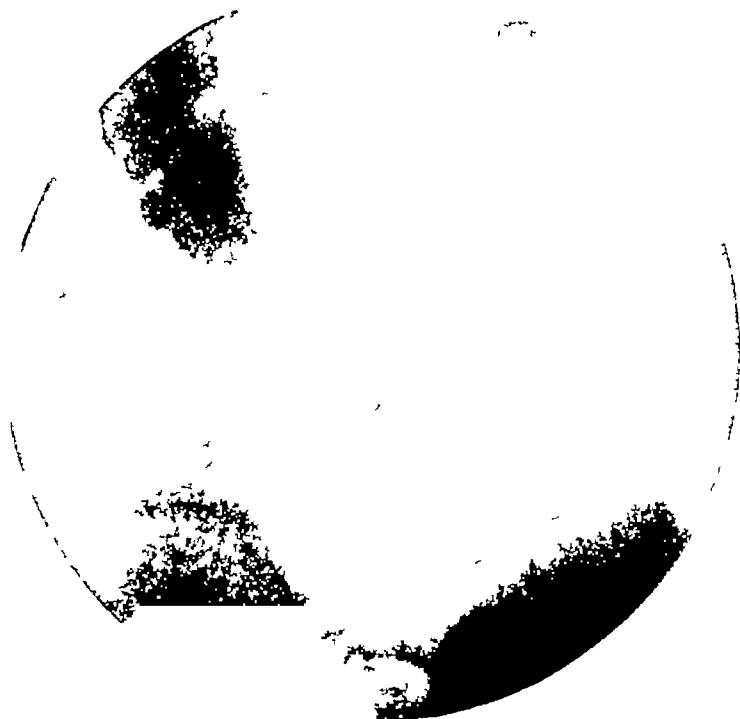
Appendix showing a fixed loop

Fig 9



Tip of appendix adherent so that loop was fixed

FIG 10



Appendix with bulbous tip

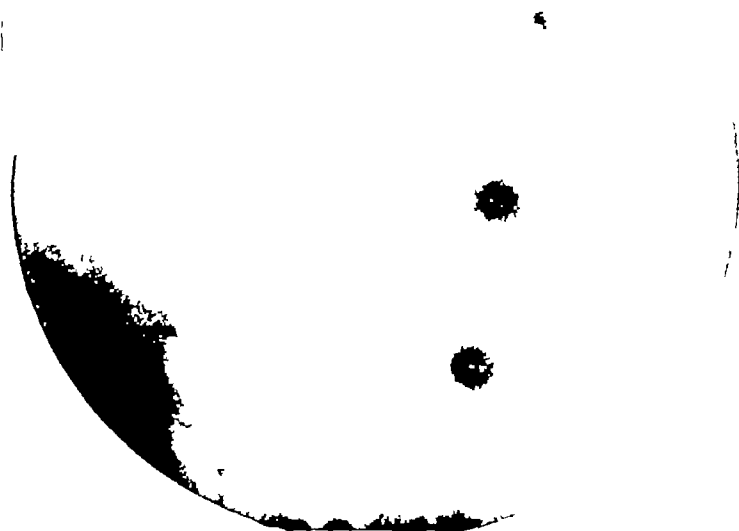
FIG 11



Leaking appendix. Specks of barium seen in sac indicating a ruptured walled off appendix. Pressure tenderness was in left lower quadrant. No tenderness over McBurney's point. (Diagnosis confirmed at operation at which time small quantities of the varium sulphate was still found in the abscess sac.)

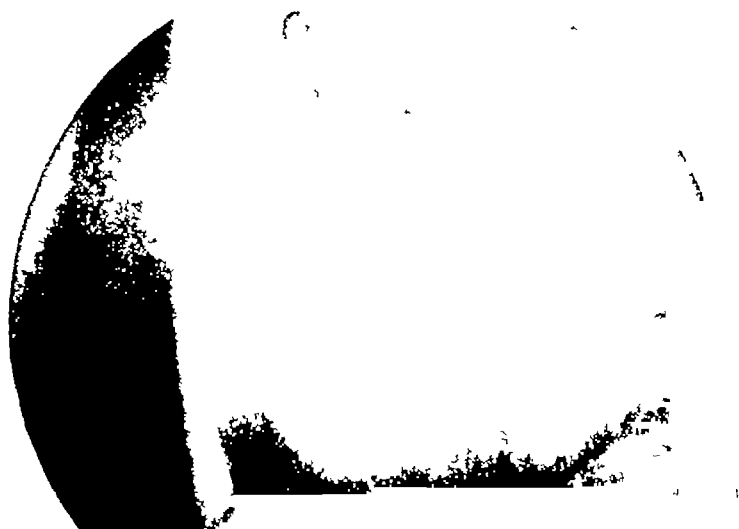
(Negative print)

FIG 12



Forty eight hour appendiceal retention

FIG 13



Forty eight hour appendiceal retention

methods of fluoroscopy and the making of rontgenograms, we come to the most difficult part of the whole procedure, namely, the question as to just what is, and what is not, pathological. It is manifestly impossible to lay down any hard and fast rules in this regard. As a matter of fact the decision as to which cases should be operated upon, and which should not, lies with the surgeon and not with the rontgenologist. In following up a number of cases in which I had reported what I believed to be a pathological appendix, and in which the surgeon had agreed with the diagnosis and performed an appendectomy, a correlation of the findings has led me to consider that an appendix having any of the following characteristics is probably pathological.

- 1 Retrocæcal and bound down by adhesions
- 2 Adhesions holding the tip in a fixed position
- 3 The presence of sharp kinks or loops that are constant and cannot be smoothed out under the fluoroscope
- 4 A constriction of the lumen at the base, with a bulbous tip
- 5 Pressure tenderness over the appendix, changing with change in position of the cæcum.
- 6 Retention of barium in the appendix *after* the cæcum is empty

This last factor is one which calls for special attention. When we find the appendix still filled with barium after the cæcum is empty, I believe it is our duty to have the patient return at the end of forty-eight hours, and if necessary daily, until the appendix is empty. It is only in this way that we can determine whether the appendix is acting as a focus of toxæmia by long retention of its contents. In several cases followed up in this way, the retention has persisted for more than a week. If barium can remain locked up in an appendix for this length of time, surely putrefying fæces can do the same.

In conclusion I wish to urge that special study of the appendix, in the course of our gastro-intestinal examinations, is most important, and especially so when we do not find any upper abdominal lesion to explain gastro-intestinal symptoms. I also believe that the appendix is not receiving the attention which it deserves, as a focus of toxæmia. (See Figs 1-13)

RELATIONSHIP OF PHYSICAL SIGNS TO THE EXTENT AND THE PROGRESS OF ACUTE APPENDICITIS

By R. J. BEHAN, M D

Pittsburgh, Pennsylvania

ACUTE APPENDICEAL inflammatory reactions may be divided into five stages (1) Simple Inflammatory Involvement of the Appendix, (2) Involvement of Adjacent Peritoneum, (3) Omental Attraction, (4) Exudate Formation, (5) Abscess Formation

To aid in the more correct diagnosis of the different stages of acute appendicitis, I will particularly and carefully discuss the characteristic symptoms associated with each stage and shall correlate the symptoms to the pathological changes taking place. The appendiceal inflammation definitely and consistently progresses, so that its rate of progress and associated changes may be divided into stages, each with determining and qualifying symptoms—

- 1 Inflammation of the appendix
- 2 Localized peritonitis
- 3 Omental attraction
- 4 Exudate accumulation
- 5 Abscess formation
- 6 Generalized peritonitis

First Stage of Acute Appendicitis—The first stage, or inflammation of the appendix, has occurred. This causes a swelling and distension of the appendix, the appendix, which is usually bent or curved, is straightened, a stretching and dragging of the meso-appendix follows, so that the outer free border which is usually concave, becomes straightened. Dragging and irritation of the sensory nerve endings in the meso-appendix with pain production results.

The following reflex symptoms, which are protective in their character, also arise

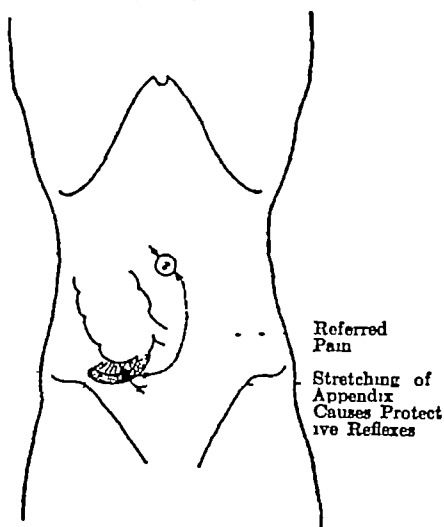
1 Central Reflexes. These act upon the central nervous system causing discomfort and anxiety and then after an excitation period,

calm resignation Or, we may have anxiety, worry, distress and restlessness These may be indicated as the onset of

- (a) General peritonitis
- (b) Rupture of an abscess
- (c) Severe toxæmia

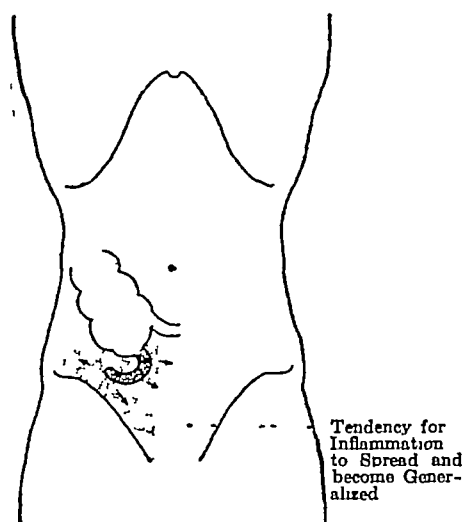
Or we may have stupor and coma, which are central phenomena,

FIG. 1.



First stage in inflammation of the appendix
—stretching of the appendix.

FIG 2



Localized peritonitis spreading upward and outward along lateral abdominal wall and downward and inward along the brim of the pelvis.

the result of intoxication from inflammatory substances produced in the appendiceal inflammatory mass

2 Somatic reflexes, which are purely protective, are referred usually to the abdominal wall They are either sensory or motor

(a) The sensory reflex produces pain, which is either local, over the area of appendiceal involvement, or is transferred to the other side or to the umbilical region. Pain is usually first felt in the umbilical region. It may be referred down the spine in cases where the appendix is retrocaecal, or, if pressure is made upon the psoas muscle, across which the ilio-lumbar nerve passes (the ilio-inguinal and ilio-hypogastric), pain is produced which is referred to the inner and lower mid part of the right side of the abdomen. It may also be felt in the scrotum and the inner aspect of the thigh. Or the pain may be felt directly in the back.

It may be projected to the area of sciatic distribution. There is also present at this time, areas of hyperæsthesia, the so-called Head zones. These are important and may, of themselves if present, be sufficient to form a diagnosis.

(b) The motor sensory protective reflexes These produce passivity in the patient, the position of dorsal decubitus The patient does not desire to be moved, does not want to be touched, and especially is active in the protection of the abdomen, to do this, he assumes the posture which is called the "peritoneal protective posture" That is, the patient places one hand lightly over the abdomen and with the other, attempts to ward off any possibility of anything or anyone touching the abdominal wall Flexure of right leg, at hip, is present. This relieves to some extent tension on psoas and rectus and supports bed clothing so that the abdominal wall is protected from any undue pressure

There is also present abdominal rigidity which is a protective somatic reflex, producing lack of motion and rigid contraction of the abdominal muscles There is absence of abdominal breathing, so that in these cases where the infection is severe, we notice a lack of up and-down movement, especially of the lower abdominal wall

A further symptom which is of great importance is the absence of superficial abdominal skin reflexes That is, on stroking the skin of the abdomen with the finger or with a sharp instrument, there is no contraction of the abdominal muscles This is one of the most sensitive and one of the best defined of the symptoms indicating peritoneal involvement provided it is absent only on the side involved.

Then there are the splanchnic-motor-protective reflexes In the intestines this is an absence of peristalsis which may be due to local paralysis of the wall from the adjacent toxic substances The intestinal paralysis causes abdominal distension and marked constipation There is also present, splanchnic-reflex-irritability which causes vomiting and nausea which are protective They inhibit the taking of food into the stomach in that peristalsis, which usually accompanies the ingestion of food, is not stimulated A rapid pulse and dry tongue are also indicators of the degree of toxæmia

Second Stage of Acute Appendicitis—This is the stage of localized peritonitis with gradual spreading of the inflammatory process In this phase there is a tendency for the inflammation which has been located definitely to the appendix and the meso-appendix to become more generalized and to spread, with associated pus formation, either along the brim of the pelvis or upward to the outer side of the cæcum and the ascending colon

This local parietal peritoneal irritation, due to inflammation, produces local pain If, however, the parietal peritoneum is not involved, there is no local pain Local pain, when the peritoneum is involved, gradually and inversely increases in severity as the umbilical pain decreases In addition to the local irritation pain there also occurs a distension pain, when, because of local intestinal

wall involvement, a local bowel paralysis and accumulation of gas occurs, so that intraluminary distension of the cæcum and adjacent bowel segments follows. When the inflammation becomes generalized and general peritonitis results, the following three groups of symptoms are defined

1 Sensory or sensory-reflex symptoms. These consist of pains which are diffused over the entire abdomen. As a result of the pain which is present in the abdomen, the patient assumes a protective attitude, *i.e.*, a position in which the patient reclines flat upon the back with one hand flat upon the abdomen and the other hand raised over the abdomen in a guarded position, ready to ward off anything or any person who should approach the abdomen.

2 Sensory-motor reaction symptoms. These consist of (a) inefficient abdominal breathing, (b) absence of abdominal reflexes, (c) rigidity of the abdominal musculature, (d) flexion of the lower limbs upon the abdomen, (e) hiccoughs, due to involvement of the diaphragm, (f) tympany of ascending colon, (g) decrease in amplitude of respiratory movement, (h) rapidity of pulse, (i) absence of peristaltic sounds, *i.e.*, localized paralysis (*i.e.*, ileus) of the bowel. If the tympany is due to gas, peristaltic sounds are present but are reduced in volume. When the tympany is the result of localized intestinal wall involvement, no peristaltic sounds are heard.

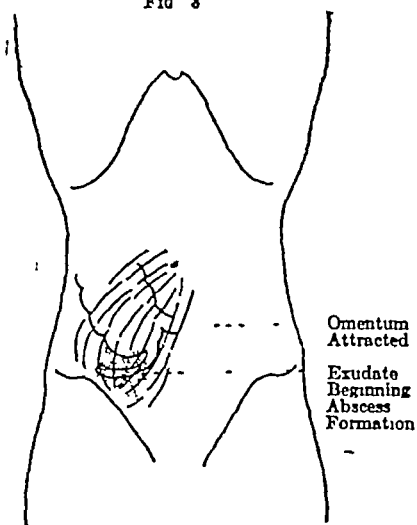
3 Toxic symptoms which consist of (a) Pulse rate, increased out of proportion to the respiratory rate, (b) sub-acute nephritis, casts and albumen are present in the urine which has become less than normal in quantity, (c) the liver becomes involved and mild bile retention occurs, examine blood for quantitative bilirubin with van den Bergh's method, (d) there are chills at the outset and sometimes high fever. This usually means gangrene of the appendix, though it is remarkable how extensive a destruction to the appendix can occur with mild general symptoms, (e) blood reaction symptoms, such as an increase in the leucocytes and relative increase in the polymorphonuclears, depending on the severity of the infection. We have always noticed a high blood count, *i.e.*, polymorphonuclear increase with gangrene of the appendix. The sedimentation blood test may be used. The rate is increased.

This stage is graphically shown in Figure 2

Third Stage of Acute Appendicitis—In the third stage of acute appendiceal involvement, the organism is definitely and locally mobilizing her forces of resistance. Omental attraction occurs and adhesions are formed. The omental attraction becomes pronounced as soon as there is any acute peritoneal inflammatory reaction in the abdomen.

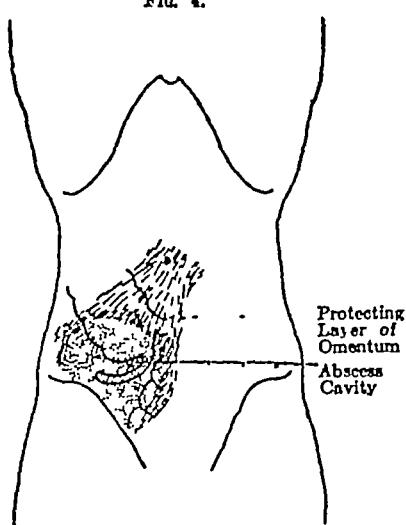
As soon as inflammation occurs and mobilization of the omentum takes place, the omentum moves toward the involved area and attaches itself around the inflamed tissue, so that it is entirely walled off from the general abdominal cavity.

FIG 3



Third stage. Omental attraction

FIG 4.



Fourth stage. Exudative abscess—additional symptoms emerge into recognition.

On making a local abdominal examination we find, on palpation, a definite mass in the lower right quadrant. On percussion there is a sharply accented increase in dulness over the area corresponding to the mass. If the vomiting has ceased, it again recommences. This reappearance of vomiting indicates a further extension of peritoneal irritation. We may also find an indefinite area of dulness (the mobilized omentum) extending from the area of absolute dulness toward and beyond the umbilicus in a direction from the lower right quadrant upward and toward the upper left quadrant. On attentive listening there is distinguished, combined with this high-pitched dull note, a lower pitched tympanitic sound. This sound is transmitted

through the mass (the omentum), percussion over which produces the higher pitched sounds which have been defined. Deep pressure on the left side of the abdomen with a dragging movement toward the left outer wall of the abdomen, in a line of direction upward and toward the left, produces traction on the omentum and usually causes pain in the lower right side, around the area of attachment of the omentum to the inflammatory appendiceal mass. At this stage there is also a noticeable bulging on the right side. During the period when the above symptoms are evolving into prominence, the inflammatory cause of the symptoms has gradually been developing until a definable exudative formation is demonstrable and the fourth stage is present.

Fourth Stage of Acute Appendicitis—The following symptoms now become emphasized.

1 From a slight decrease in resonance over the area where the cæcal wall is infiltrated, there evolves a definitely delimited area of dulness as the actual exudate takes place and a mass, including both exudate and bowel, is formed.

2 At first resistance in the lower right iliac region is indefinite, but as the pathologic changes become more severe and the exudate increases in quantity it increases and defines itself as a sharply defined tumor formation. This mass can be determined by the palpating fingers and its borders accurately and exactly defined by auscultatory percussion.

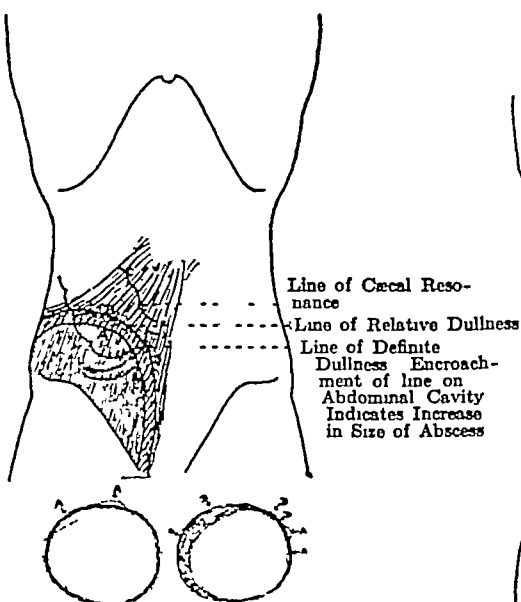
3 As the exudate further increases in quantity, there is a more definite bulging of the abdominal wall. It should also be noted that a bulging of the abdominal wall on the right lower quadrant may also be present in the very early stages of appendicitis. At that time the bulging is due to the contraction of the right rectus muscle over the involved appendix which causes definite and apparent swelling. Bulging may also be increased by the paralysis and distension of the loops of bowel adjacent to an appendiceal abscess, when gas accumulates; this not only gives rise to distension pain but also to definite mass formation which is tympanitic on percussion.

4 The diffused resistant tumor mass in the right lower quadrant (when the appendix is involved and the exudate becomes marked) is slightly movable but very painful in the very early stages. In the

latter stages it may, on careful palpation, give the impression of fluctuation, but it is immovable

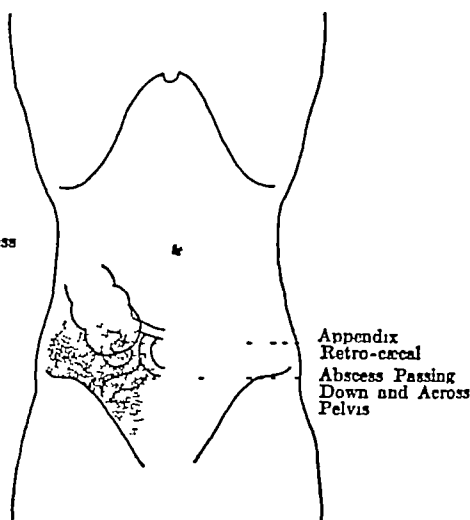
5 In the fourth stage, when the exudate has extended to the outer right abdominal wall, there is a localized tenderness toward the outer right side of the abdomen, from the anterior-superior spine almost to the margin of the ribs. Resistance to pressure (by the oblique abdominal muscles) is also present in this area. There is also tenderness on palpation and dullness on percussion

FIG 5



Fifth stage. Abscess formation

FIG. 6



Retrocecal appendix.

Fifth Stage of Acute Appendicitis—As the inflammation progresses, pus accumulation takes place, and an abscess is formed. This usually has a definitely determinable margin and is localized to one spot by the bulwarks of fibrin which have been thrown up around it. On percussion the area of dullness extends usually over the cæcum, down toward the pelvis and into the right lower quadrant. The centre may or may not be over what would correspond to the location of the base of the appendix.

The boundaries of this dull area correspond to the limits of the abscess. Encroachment of the limiting line dull note (A, Figure 5) on the abdominal cavity tympanitic percussion note means increase

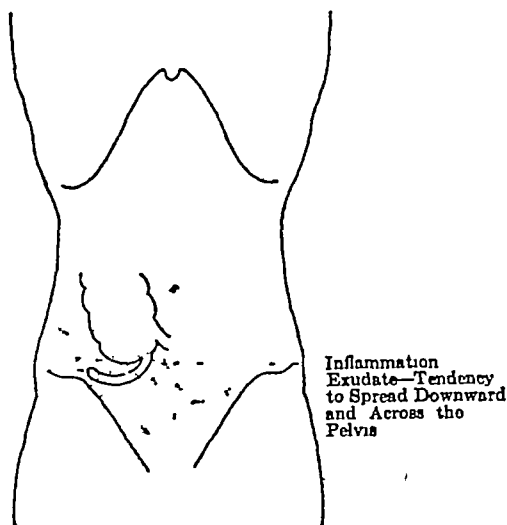
in the size of the abscess. By careful percussion of the abdomen, it will be noted that there is gradually emerging next to the dull note of the abscess, a zone of higher pitched notes hardly perceptible at times, yet always definite, as changes from resonant note of the cæcum and that of the small bowel into the dull note of the inflammatory exudate. This intermediate zone which, by careful percussion, usually can be fairly accurately defined is important in determining the increase or the decrease of the inflammatory process. When the inflammatory infiltration of the cæcal and intestinal walls increases, as when an abscess is becoming larger, the boundary line (*b*) of this zone becomes longer and encroaches upon the abdominal cavity and if the inflammation is very severe, it becomes further separated from line *A*. Likewise, as the inflammatory reaction decreases, the line *B* approaches the line *A* and the line *A* approaches the lateral abdominal wall or becomes shorter, until it sharply defines the diminishing appendiceal abscess cavity, which is more definitely walled off as the pus is absorbed and there remain only exudate and infiltrated omentum and bowel. As resolution continues, the area of absolute dullness gradually diminishes in extent until it finally disappears.

The cause of the change of note at line *B* from the resonant note of the cæcum or the small intestine to the higher pitched note, is that the normal cæcal wall is elastic and when filled with air and when struck, vibrates and responds with a resonant note. However, when the wall is infiltrated and inflamed, it does not vibrate with as great an amplitude, *i.e.*, the wave length is less and the resultant sound is of higher pitch. At *C*, with unimpaired intestinal wall, the amplitude is greatest. At *B*, with wall infiltration, it is less. At *A*, with considerable infiltration, it does not respond at all, therefore, the sound is high pitched, *i.e.*, dull.

In case of intra-abdominal inflammation the first reaction which takes place in the adjacent intestines is an infiltration of the wall which is indicated by a decreased resonant note of higher pitch. As the inflammation progresses and the wall becomes infiltrated in a constantly progressive rate, the note becomes of still higher pitch and approaches to that of flatness (due to the decreased amplitude of vibration in the walls of the bowel). These changes are of some value in deciding upon the progress of inflammation anywhere in the abdominal cavity, especially are they of value in deciding upon

the increase or decrease of inflammatory reaction in the appendix and the surrounding tissue, and frequently are more reliable in estimating the severity of an attack than are the pulse rate and temperature change. The pulse and temperature change depend upon absorption of toxic material from the diseased area and, as the rate of toxic absorption is not by any means definite and constant, symptoms dependent upon it are not absolutely reliable indicators of the progress of the disease, nor are they reliable criteria in determining the advisability of operation. The pulse is influenced by so many

FIG. 7



Pathway of inflammatory process from right to left.

other factors, such as fear, fright, anxiety, etc., that in the early stages of appendicitis it is well not to pay too much attention to it, unless it remains high without remission. If it does this, of course, it means that marked toxic absorption is taking place and this in a way may be taken as an indicator of the degree of appendiceal inflammation, but as an indicator of the advance or the retrogression of the inflammatory process, it is of no value.

Sixth Stage of Acute Appendicitis—The appendiceal abscess now present tends to spread along the brim of the pelvis directly across to the left side, many times however it gravitates downward and involves the right pelvis. The frequent immunity of the pelvis in this progressive inflammatory advance is probably due to the wall-

walled-off (of the pelvis) by the agglutinated intestines, which lie in the pelvis. Transverse progress occurs when the inflammation passes from one side of the abdomen to the other over the agglutinated adjacent loops of inflamed intestines, which fill the pelvis, the omental defense being insufficient. The symptoms, pain and localized tenderness are usually most marked over the inflamed intestine which is in contact with the anterior wall in the section of the abdomen last involved, that is, in the area where the inflammation is progressive. The inflammation resembles a forest fire, it causes the most violent reaction at the margin of its advance, leaving destruction and inactivity in its wake. It may be taken almost as absolutely positive that the presence of an encapsulated abscess means abatement of acute inflammatory symptoms.

When the inflammation has progressed across the brim of the pelvis to the left side there is present

- 1 More pain on the left side than on the right. The nerve endings in the walled-off area of the right side have become desensitized, because of the inflammatory exudate and no longer give painful reactions. On the contrary, on the left side, the tissues have not as yet become deadened, in fact, because of inflammation, the nerve terminals are all the more sensitive and react with pain sensation on the slightest stimulus.

- 2 There is dulness extending across the lower abdomen.

- 3 Lessened superficial reflex contraction approaching to abdominal muscular immobility, induced on stroking the skin of the abdomen.

- 4 The abdominal breathing is restricted and limited to the upper portion of the abdomen. There may be more limitation of breathing on the left side than on the right.

- 5 Bulging may be present on the right and absent on the left side or vice versa, the bulging on the left side may gradually increase until it is more marked than on the right side.

- 6 There is gradual easing of right-sided abdominal symptoms such as pain and tenderness.

- 7 There is absence of pelvic symptoms.

- 8 There is also absence of peristalsis on the left side.

- 9 Abdominal rigidity is more marked over the lower left than over lower right quadrants.

Generalized Peritonitis—In any stage a sudden leakage of the inflammatory products into the general peritoneal cavity will cause a generalized peritonitis. The appearance of the patient immediately changes, he has an anxious, drawn expression. The pus, which may have been localized, now becomes diffused over the entire abdomen, the pulse, which at first was not rapid, quickly becomes rapid and thready, the leucocytes are greatly increased, the abdomen becomes very hard, rigid and painful to the touch. Abdominal breathing and abdominal skin reflexes are absent. Vomiting, which may have been absent, again commences. The picture is that of one extremely ill. When this occurs, do not delay operating, for the patient has a generalized peritonitis.

PHYSICAL THERAPY IN TRAUMATIC CONDITIONS *

By RICHARD KOVACS, M D

Clinical Professor and Chief of Physical Therapy, Polyclinic Medical School and Hospital, Physiotherapist, Reconstruction Hospital, New York City

THE use of physical measures in acute, subacute and chronic traumatic conditions forms an essential part of their modern treatment. Following the impressive object lesson furnished by the extended application of physical measures during and after the Great War, physical therapeutic departments have been established in the United States of America in connection with industrial plants, insurance companies, and in all progressive hospitals treating traumatic cases. Unfortunately, the equipment and the actual operation of these departments varies very considerably. At the low end of the scale are some industrial clinics organized on an entirely commercial basis where "baking and massage" is ordered as a routine in all cases of injury and applied by a masseur or nurse, often perfunctorily and without competent supervision. At the upper end of the scale are well organized departments equipped with all the modern measures of physical therapy, including electrotherapy, thermo- and hydrotherapy, phototherapy, massage and mechanotherapy, and operated under the direction of a skilled medical director and in organic cooperation with the surgical and the other departments of the hospital or industrial plant. Results differ according to these divergent standards, and it may be well to state that the overplaying of physical therapy as an added measure of revenue by a few commercially inclined organizations and physicians already threatens a setback in the employment of this important part of therapeutics. A recent report of the Committee on Traumatic Surgery of the American College of Surgeons ¹ states that in the large majority of cases physical therapy as now rendered is of little value. In reply, Granger ² emphasizes that an analysis of this report makes it evident (1) that in many cases the surgery was so poor that treatment by physical therapeutics or by anything else

* Read before the Fifth International Medical Congress for Industrial Accidents and Occupational Diseases, Budapest, September 2nd-7th, 1928

could not overcome this handicap, and (2) that in many cases the physical therapy, to put it mildly, was unintelligently prescribed and applied

The practical application of physical therapy to traumatic conditions demands

1 A complete diagnosis in every instance The careful initial examination should always include definite findings as to (1) state of injury or repair contour of limbs and joints, condition of scars, measurement of circumference, union of bones, (2) state of function range of motion in joints, strength of muscles (grip testing, etc), (3) special examinations such as electrical and sensory tests in nerve injuries Rontgenograms are well nigh indispensable in most instances

2 Consideration of the existing pathology or functional disability and the selection of the appropriate physical measures to meet the individual case It is not a question of a certain apparatus to be applied to a certain diagnosis, but rather of a certain physical agent or combination of agents to the existing condition Physical therapy should by no means be confused with apparatusotherapy

3 Periodic check up of the results by frequent examinations, which should always be carefully recorded, together with such changes in treatment as the conditions warrant Physical therapy is only prefunctory when a patient continues to receive the same treatment for months without any attempt to ascertain progress

4 Periodic consultation with the referring surgeon This will enable the surgeon to appreciate the possibilities and limitations of physical therapy

5 A definite procedure for discharging patients and recording end results

In this presentation I can only consider briefly (1) the available measures, and (2) their indications in the most frequent traumatic conditions

PHYSICAL MEASURES

Thermal Measures—Heat is a form of energy and when applied therapeutically causes (a) active hyperæmia, the result of relaxation of the smaller arterioles The increased arterial and venous flow brings on more oxygen with improved nutrition, and the

FIG 1

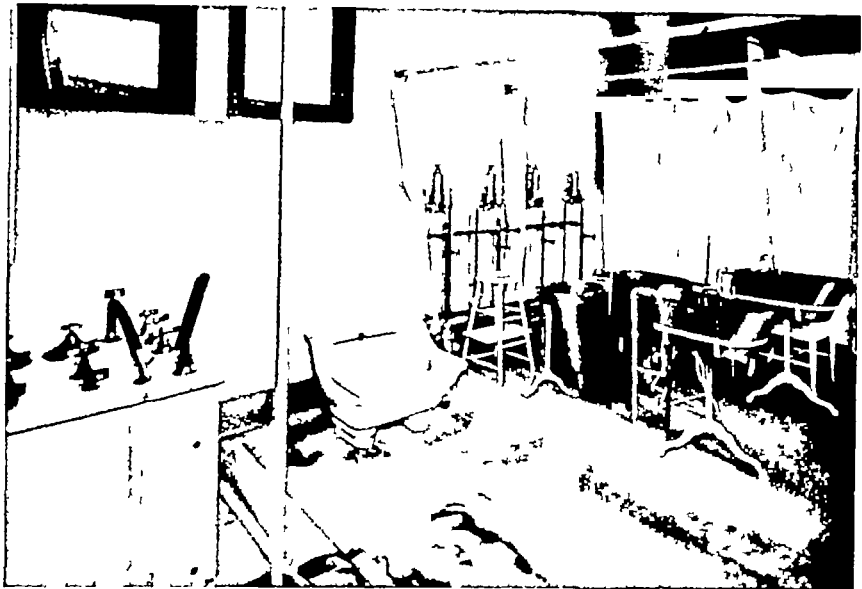


Main treatment hall Physiotherapy Department Reconstruction Hospital New York

FIG 2.



Individual treatment cubicles New York Reconstruction Hospital



Hydrotherapy room New York Reconstruction Hospital Group of whirlpool baths

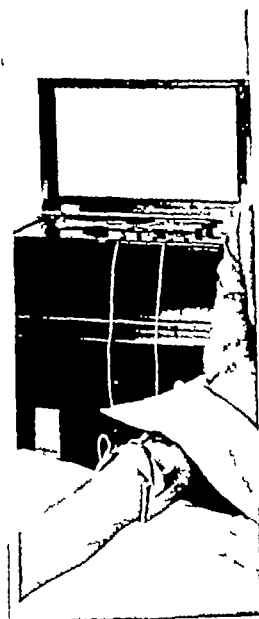
FIG. 5

PHYSICAL AGENCIES AND SOME OF THEIR EFFECTS

Hot water Hot air Radiant heaters Incandescent lamps Sun Diathermy	THERMIC	Relaxation of tissues Hyperaemia Relief of pain Attenuation or killing of germs Reflex stimulation
Cold water		Contraction of tissues Anaemia
Sun Heated metals Carbon arc Mercury vapor arc	PHOTOCHEMICAL	Erythema of skin Killing of germs Relief of pain Increase of solid content of blood
Galvanic current and variations	ELECTROCHEMICAL	Pos. pole { vasoconstriction acid reaction Neg. pole { vasodilatation alkaline reaction Interpolar - metabolic
Interrupted wave, and alternating currents Vibration Massage	DYNAMIC	Muscle and tissue contraction
		Increase of venous and lymph flow stretching of tissues reflex stimulation

All effects may be mild (stimulation) or exaggerated (destruction) local general or reflex according to the intensity duration, and area of application

FIG 7



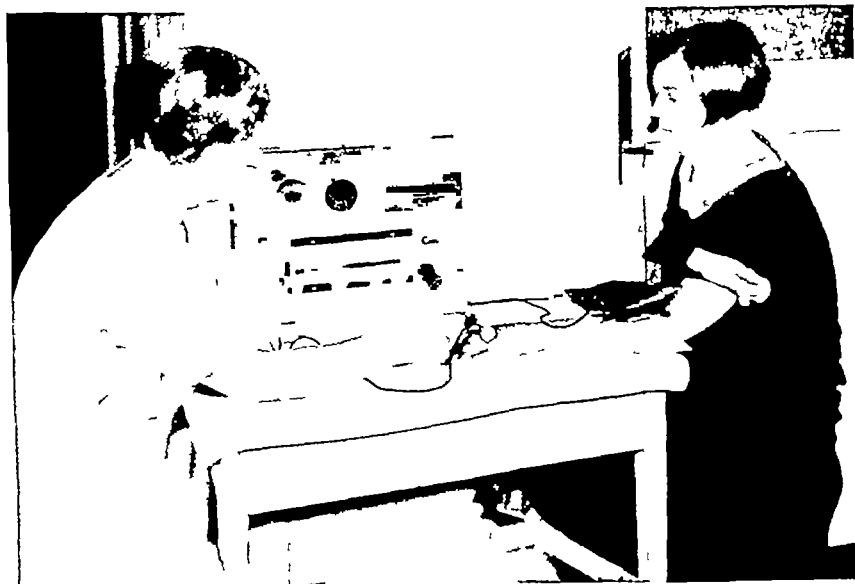
Diathermy to knee by
transverse method

FIG 6



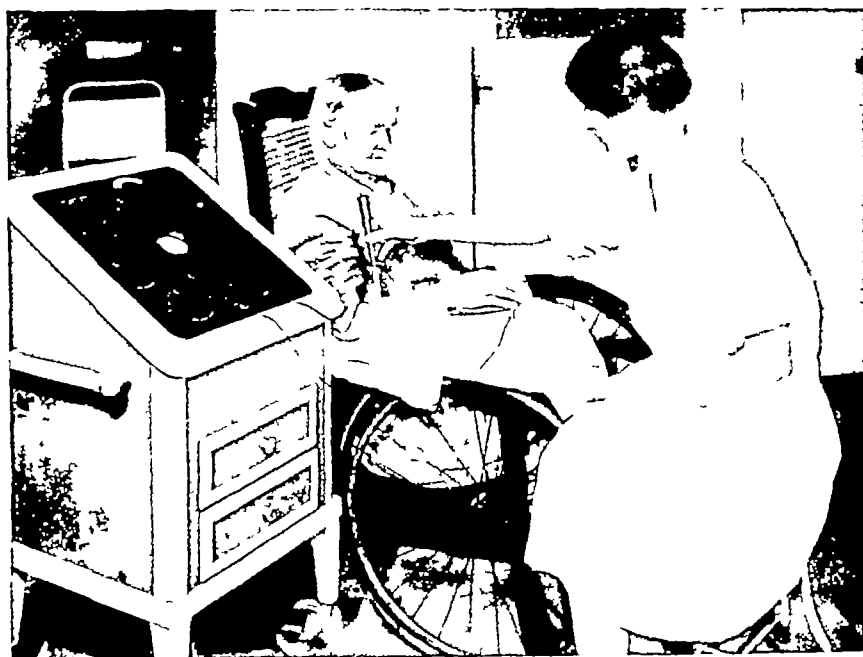
Diathermy to shoulder by transverse method

FIG 8



Electrical testing for nerve injury

FIG. 10



Sinusoidal current applied for weakness of forearm muscles following fracture

FIG 12



Corner of occupational therapy department New York Reconstruction Hospital

increased venous flow carries away in a larger degree the by-products of local metabolism and thus the process of repair, as in healing of wounds after injuries, is speeded up (b) Relief of pain, either

Fig. 4.

POLYCLINIC HOSPITAL		PHYSICAL THERAPY		No. _____	
NAME _____					
SEQUENCE	DIAGNOSIS:	DURATION			
	PART TO BE TREATED:				
PHOTO THERAPY	Radiant heat lamp, infrared				
	Actinic local AC WC carbon " " general				
MECHANIC THERAPY	Massage, sedat. stimul.				
	Vibration				
	Exercise, active " passive, resistive				
STATIC	Wave, spark gap _____ inch.	ELECTROTHERAPY			
	Sparks, short, long				
	Brush, head breeze				
	Diathermy _____ MA				
HIGH FRE QUENCY	Monoterminal				
	Autocondensation _____ MA				
GAL- VANISM	Modified Diathermy				
	Continuous, interrupted				
	Sinusoidal slow interrupt				
FARA- DISM	Bristow coil				
	Surge				
	Muscle and nerve test				
	Notes:				
ELECTRO- DES FOR	Diathermy to _____ size _____ inch				
	Galvanism, positive to _____ negative to _____ size _____ inch				

Chart for Physical Therapy, Polyclinic Hospital.

by inhibition of the temperature nerve endings of the skin or by the acceleration of blood movement by relieving vascular stasis or diverting of blood from congested parts. On account of these two

principal effects, heat is invaluable in traumatic conditions. Thermal measures can be classed in two groups.

(1) Measures producing surface heat. Among these, radiant light and heat from incandescent lamp sources are the most useful. According to their candlepower, they can be used for the treatment of small or large areas and are convenient and safe. It is estimated that the radiation from these sources penetrates the tissues to the extent of about two inches.³ Other means for producing surface heat include dry hot air ovens and hot paraffin baths, for which better results are claimed on account of the increased skin toleration towards dry heat. Both of these are finding only very limited use nowadays on account of their expense, their complicated handling and their dangers. Hot whirlpool baths consist of water at a temperature of from 100° to 110°, rapidly agitated in a container by its own pressure or by compressed air or by a suitable motor. The latter furnish a combination of heat and gentle massage and improve local circulation effectively in conditions of peripheral nerve injuries, indolent ulcers, adherent scars, post-inflammatory stage of infections of the hand, as well as in recent fractures, immediately after the removal of the plaster-of-Paris bandage. Electric cabinet baths, followed by hot and cold douches are beneficial in traumatic neuroses. In case of chills after exposure, shock following injuries, the immediate application of radiant light and heat may act as a life-saver. A large radiant light and heat applicator should be part of the equipment of every accident ward, replacing the cumbersome and dangerous hot water bottles.

(2) Measures producing through-and-through heating of all tissues. The modern type of high frequency current, known as diathermy, is an important measure in the treatment of many traumatic cases. While all of the surface applications of heat exert a certain effect on the deeper circulation, diathermy penetrates through all tissues in the path of the current and seems to exert more analgesic and antispasmodic action. Its beneficial effects in arthritis, neuritis, bursitis and many other conditions have created a tendency in America to use it in many conditions where the simpler forms of superficial heat are just as effective.

Ultraviolet Radiations—On account of their chemico-physiological effects, general ultraviolet radiations may be used as an impor-

tant adjuvant in all forms of secondary anæmia, general debility, convalescence following traumatism. Either natural heliotherapy or irradiations from a mercury vapor or carbon arc lamp may be

FIG. 9

THE RECONSTRUCTION HOSPITAL.

LOWER EXTREMITY

MUSCLE AND NERVE TEST

Name _____	Number _____	Diagnosis _____								
		Date			Date			Date		
		Farad.	Condens.	Galv.	Farad.	Condens.	Galv.	Farad.	Condens.	Galv.
N. FEMORALIS										
Sartorius _____	R.									
	L.									
Rectus Femoris _____	R.									
	L.									
Vastus Internus _____	R.									
	L.									
Vastus Externus _____	R.									
	L.									
Pectineus _____	R.									
	L.									
Adductor Longus _____	R.									
	L.									
N. SCIATICUS										
Gluteus Maximus _____	R.									
	L.									
Gluteus Medius _____	R.									
	L.									
Biceps Femoris _____	R.									
	L.									
Semitendinosus _____	R.									
	L.									
Semimembraneous _____	R.									
	L.									
N. PERONEUS (Ext. Poplit)										
N. PERONEUS PROFUNDUS										
Tibialis Anterior _____	R.									
	L.									
Extens. Longus Digit _____	R.									
	L.									
Extens. Longus Halluci _____	R.									
	L.									
Extens. Brevis Digitorum _____	R.									
	L.									
N. PERONEUS SUPERFICIALIS										
Peroneus Longus _____	R.									
	L.									
Peroneus Brevis _____	R.									
	L.									
N. TIBIALIS (Int. Popliteal)										
Gastrocnemius _____	R.									
	L.									
Soleus _____	R.									
	L.									
Flexor Longus Digitorum _____	R.									
	L.									
Flexor Halluci Longus _____	R.									
	L.									
Tibialis Posterior _____	R.									
	L.									

Record chart for electrical muscle and nerve tests.

employed. Local irradiations are valuable in some infections and burns, and also for the stimulation of epithelization.

Electrochemical Measures—Galvanism will benefit some forms of acute neuritis and chronic joint conditions, which are not favorably influenced by the more intensive thermal measures. The

action of the negative pole, if directed over adherent scars, will result in their softening. Electrochemical action is primarily responsible for muscle and nerve stimulation by interrupted, wave and alternating currents, although these effects are dealt with under mechanical measures.

Mechanical measures form an indispensable part of the treatment of traumatic conditions. They are applied (1) for their local effects in improving the circulation, removing the immediate effects of trauma—hemorrhage, exudation and muscle spasm—or its remote effects—adhesions and stiffness, (2) for exercising weak and flabby or fully paralyzed muscles, (3) and by their reflex action on remote nerve centres.

Massage is the simplest and most popular mechanical measure, requiring a pair of skilled hands and a trained head for its application anywhere. Physicians should learn how to apply massage themselves, or at least when and how to prepare it. To tell the patient to go out and get "some" massage or "some" electricity is equivalent to an instruction to go to the pharmacy and get "some" medicine. Massage usually works to best advantage when properly combined with other physical measures, such as preliminary deep or superficial heating and subsequent active or passive exercise or electrical muscle stimulation.

Therapeutic exercise, active and passive, is valuable in increasing the range of motion of joints and in redeveloping muscle power after all forms of traumatism, chronic inflammatory conditions, partial paralysis and deformities. Active exercises are especially valuable because of their value in increasing muscle coordination. Resistive exercises, if properly applied, enable localization of the treatment to the joints and muscles to be exercised. As to mechanical treatment by apparatus, the present tendency is to use apparatus of very simple construction. Rowing machines, nautical wheels, and other appliances of the gymnasium type have largely replaced some of the elaborate apparatus formerly used requiring much space and needlessly costly.

Occupational therapy is an important adjunct to active exercises because it furnishes healthful activity for mind and body, overcomes functional disability and reestablishes capacity for industrial and social usefulness. A well conducted occupational therapy department

should be part of any clinic or hospital devoted to the treatment of industrial disabilities

Electrical currents of low tension and low frequency form a unique method for the treatment of muscular weakness and of real paralysis in nerve injuries. Electrodiagnosis or the testing for the reaction of degeneration furnishes an accurate test from the viewpoint of diagnosis, prognosis, and therapy. Absence of RD is found

FIG. 11.

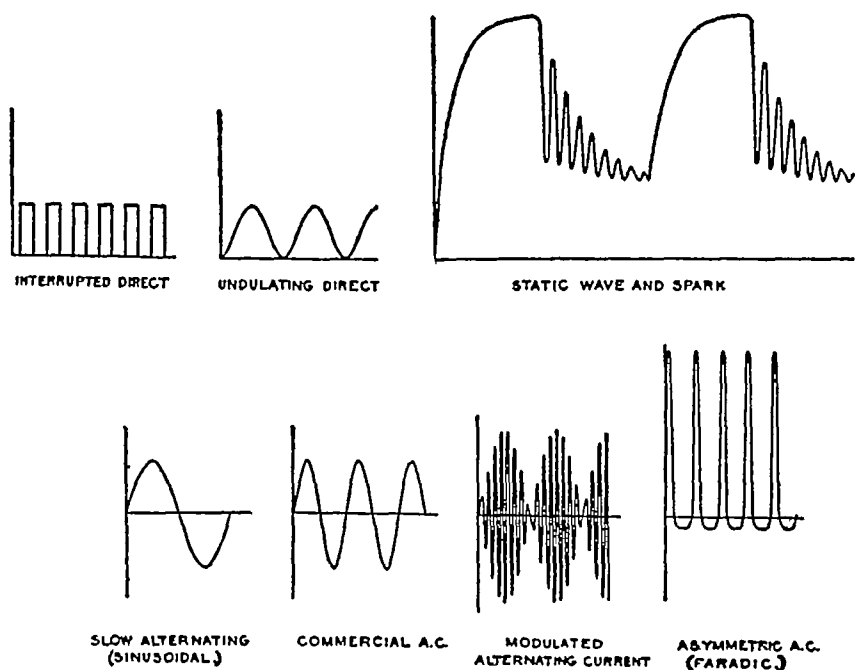


Chart of exercising currents.

in lesions of the upper motor neuron (accompanied by spastic paralysis) in hysterical and simulated paralysis. RD occurs in lesions of the lower neuron—the anterior horn cells or the peripheral nerves (accompanied by flaccid paralysis), and proves that nerve conduction is seriously impaired due to traumatic or toxic degeneration.

The surging faradic current will actively exercise weak and flabby but not paralyzed muscles. Interrupted galvanic currents, or slowly or rapidly alternating sinusoidal currents induce graduated contractions in paralyzed muscles which cannot be produced by any

other means. Such treatment preserves the deficient function of contraction until the muscle regains its connection with its spinal centre. Electrical stimulation also enables us to exercise any individual muscle without moving the joints upon which it acts, and without putting any strain on the patient. These exercising currents form, therefore, a valuable addition to the treatment of traumatic cases where loss of muscle and nerve function is involved. In the United States the static machine (franklinsation) is extensively used for the production of molecular tissue massage, for promotion of tissue drainage (static wave current) and for breaking up minor adhesions by disruptive discharges (static sparks). Static treatments are valuable for both the immediate and remote effects of trauma of the soft parts, and are easier and more effectively administered than hand massage. Mechanical vibration by a motor-driven apparatus is another useful measure for regulated local manipulation.

INDICATIONS IN TRAUMATIC CONDITIONS

Only the guiding principles for the indications and application of physical measures in the most frequent forms of traumatic conditions can be presented here. That in every instance a definite diagnosis has been established by all recognized means is taken for granted, differential diagnostic points are therefore mostly omitted.

Recent Injuries—The pathology of recent injuries, such as sprains, strains, contusions, traumatic myositis, consists of extravasation of blood and lymph, of tearing of ligaments and muscle tissue, and of injury to articular surfaces and adjacent tendons. A protective muscle spasm usually accompanies such injuries immediately. After the acute stage the exudations become organized, adhesions are formed as bands and strings, in which sensitive nerve filaments may become imbedded, and stiffness and pain may persist. The time-honored treatment of prolonged immobilization after such injuries ignores the fact that for the repair of injury an efficient blood supply is necessary and that absolute rest reduces such blood supply to a minimum, second, that such absolute rest promotes the organization of what may be called the coagulable lymph and induces the formation of intra- and peri-muscular as well as peri-arthritis adhesions. In immobilized extremities there also develops an early reflex atrophy of muscles, resulting in disuse. The modern tendency in the treat-

ment of recent injury is to provide immobilization only when absolutely necessary for the proper coaptation of broken surfaces, as in fractures or tendon injuries, and in torn ligaments, but otherwise to employ efficient physical means to prevent the organization and to hasten the absorption of the extravasated material by driving it into the lymphatics to be carried off and to preserve the functional activity of the limb

Following acute traumatism, in which the injury does not demand immobilization, immediate application of a suitable mechanical measure, such as massage, the static wave current, or the sinusoidal current, will hasten the dissipation of the exudate and prevent adhesions. The application of thermal measures immediately after trauma is usually not well tolerated. The static wave current and brush discharge, or the time-honored ice-bag or any other form of cold causing vascular contraction and the decrease of swelling, usually gives quicker subjective relief. With the passing of the acute stage some thermal measure should be employed for the improvement of circulation and for the relief of pain, and as introductory to suitable mechanical measures. The early application of relaxed passive movements will act as a further preventive of stiffness by the breaking down of adhesions, later, active movements are instituted. Fixation of the affected part by splinting or adhesive after the completion of each treatment should be used as long as it is absolutely necessary.

Fractures —The modern method of treatment by suspension and traction and the avoidance of constricting plaster-of-Paris bandages permits the early application of radiant light and heat and gentle massage to relieve pain, promote active circulation, and muscular relaxation. Early motion of the adjacent joints acts as a preventive to the secondary disabilities formerly expected with fractures. All this treatment can be carried out at the bedside and must be done with utmost care so as not to displace the fragments. In later stages the main efforts are directed to maintain the activity of muscles and the function of all joints. Edema, swelling, painful callus formation are an indication for diathermy followed by gentle massage. The saving in time alone by the modern functional treatment of fractures is best illustrated by a report from the Moses Taylor Hospital (Scranton, Pa., in 1927), showing a reduction in disability time of 21 per cent in 400 cases by physical therapy.

Reduction of Disability Time by Physical Therapy

	Before No days disabled	After No days disabled	Saving in days	Percentage of Improve- ment in disability time
Clavicle	67	59	8	12
Humerus	125	90	35	28
Radius, ulna, or both	76	64	12	16
Femur	239	180	59	25
Tibia, fibula, or both	121	92	29	24

These figures cover cases of uncomplicated simple fractures in males over fourteen years of age. All were mine or railroad employees. About 400 cases were investigated in two groups, two years before and two years after the use of physical therapy. The table shows a shortening of approximately 21 per cent in disability time.

Fibrous Ankylosis—Physical measures are indispensable to restore mobility to ankylosed joints provided that adhesions exist only between the articular ends of the bone and the capsule, or that only the capsule is adherent and contracted. Where there is serious destruction of the cartilage or marked deformity of the adjoining joint surfaces physical therapy does not promise the best results. Diathermy, massage, active exercises and cautiously applied passive stretching are recommended. Fortunately, with the modern treatment of fractures and joint injuries, less and less ankylosis is seen.

Arthritis—Traumatic types of arthritis form a very grateful field for physical therapy. In acute stages rest and the mechanical promotion of absorption should be employed, in the subacute and chronic stages penetrating heat (diathermy) followed by mechanical measures is important. Diathermy should be applied preferably by "crossfire" method, changing position of electrodes at alternate treatments.

Bursitis—Following acute or chronic strain this painful and disabling condition often develops, especially about the shoulder and elbow joints. Diathermy has given very satisfactory results to American observers while mechanical measures are usually not well tol-

erated Tenosynovitis is amenable to heat measures followed by gentle massage

Adherent Scars—Operative measures can often be avoided or at least advantageously supplemented by softening with negative galvanism (chlorine ionization) or hot whirlpool baths, followed by massage and manual stretching. Mild doses of X-ray are also indicated

Nerve Injuries—Injury to a peripheral nerve at any place below its spinal origin may result in the following (1) complete division, (2) partial division (laceration), (3) compression (by scar tissue or callus), (4) bruising. The chief symptoms may be paralysis and trophic changes, paresis or pain. Electrical tests after the first week help in diagnosis and prognosis, recovery will take several months or more in event of full RD. Contrary to a widespread belief, electrical tests cannot determine whether or not the nerve has been completely divided, but repeated testing may give indications of nerve recovery

Treatment to the site of injury for the relief of pressure, promotion of absorption, and for the indirect acceleration of nerve regeneration should be instituted at the earliest moment. According to the site and depth of lesion, radiant light and heat, diathermy or hot whirlpool bath may be indicated. For the pain accompanying traumatic neuritis, thermal measures or galvanism, coupled with rest and immobilization, are recommended. In chronic stages, where there is fibrous thickening and adhesions about the nerve, mechanical measures, the static wave current or sparks, the sinusoidal current or massage may prove useful

Gross injury to a peripheral nerve results in atrophy of muscles, trophic disturbances in the soft parts, in adhesions and faulty positions of joints. Appropriate physical measures may prevent or at least ameliorate these, and do not interfere with other indicated operative or orthopaedic procedures. Gentle electrical stimulation of muscles improves their nutrition and increases their response. Heat measures should invariably be used as an introduction to treatment, and massage of the gentlest sort, active exercise and re-educational movements should be gradually introduced and increased. Proper splinting for the prevention of shortening of the antagonists and for the relaxation of the paralyzed muscles is of vital importance and

should be done as the first part of supporting therapy. These splints must be worn until the recovering muscles have attained sufficient tone to maintain their normal position. There is no condition in which the intimate cooperation of the surgeon, neurologist and the physical therapist is more important than in traumatic nerve lesions.

Conclusions — Properly and immediately applied, physical measures form an indispensable part of the modern treatment of traumatic conditions. In industrial accidents physical therapy will speed up recovery, ameliorate suffering, and promote restoration of function. A physical therapy department should include all recognized forms of thermal, electrical and mechanical measures and should function in organic cooperation with surgeons and medical men.

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EPHEDRINE

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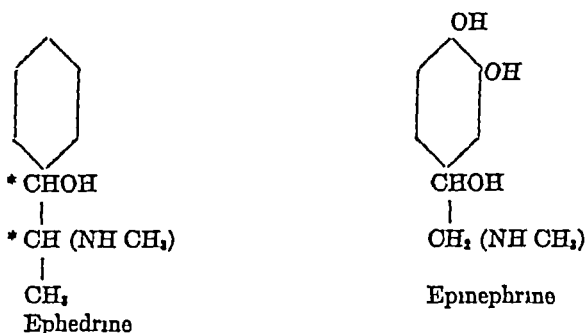
EPHEDRINE has now been in fairly widespread use for about three years. It has achieved some reputation as affording temporary relief from bronchospasm in bronchial asthma and from nasal congestion in various conditions, including hay fever. Surgeons have found it useful as a prophylactic against undue fall of blood pressure during operations. Some reports are enthusiastic as, for example, the following: "The drug is apparently entitled to a place in the category occupied by such drugs as morphine, digitalis, atropine, and the few other drugs that can be depended upon——" ¹ But all observers have noted in some patients with asthma or hay fever a production of tolerance and disappearance of beneficial effects after continued administration, and also that in a minority of patients there is no beneficial effect whatever.

The alkaloid ephedrine was first isolated by Nagai in Japan in 1887 from a Chinese plant, Ma Huang (astringent-yellow), now variously identified ² as *Ephedra vulgaris*, *helvetica*, *equisetina*, or *sinica*. Miura soon after described it as a new mydriatic, ophthalmologists appear to have made no great use of it. In Japan, Amatsu and Kubota (1913, 1917), Hirose (1915) and To (1921) carried out researches into its physiological actions. During the period from 1887 to the present, a number of researches on the chemistry of the drug were prosecuted, principally in Japan, Germany and France, and attempts at synthesis have been successful. These researches attracted little attention from the medical profession until after the reisolation of the drug by K. K. Chen at Peking in 1923, and the succeeding publication of an extended analysis of the actions of the drug by Chen and Schmidt ³ in 1924. Accounts and bibliographies of the earlier work have been given by Chen and Schmidt, Chen and Kao, ⁴ and Kreitmair ⁵

These recent investigations of the properties and virtues of ephed-

drine have reaffirmed the wisdom of the perhaps somewhat mythical Shen Nung,^{6,7} the Chinese Emperor who fifty centuries ago is said to have extended Ma Huang official recognition as a remedy for human suffering, and in great part of that of Li Shih Cheng who in 1596 A D described the drug in the Chinese dispensatory "as a diaphoretic, circulatory stimulant, antipyretic, sedative in cough, etc."⁸ It is now included by the Council on Pharmacy and Chemistry of the American Medical Association in "New and Non-Official Remedies"⁸ Since inactive ephedrine preparations have been reported on the market, physicians will do well to limit their use of the drug to the preparations accorded recognition by the Council

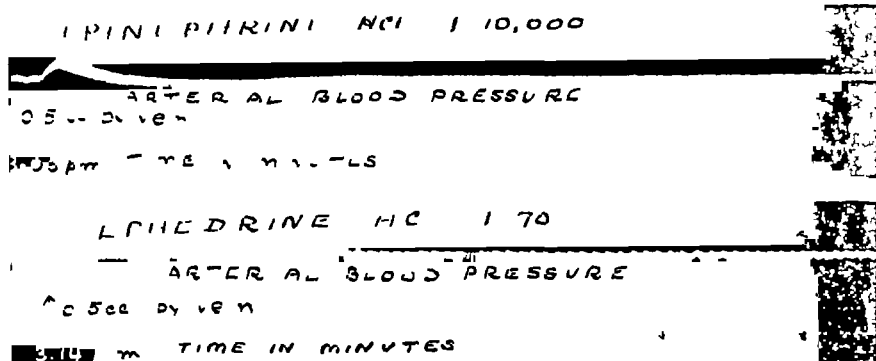
CHEMICAL AND PHYSICAL PROPERTIES



Comparison of the formulas given for ephedrine and epinephrine shows that epinephrine possesses two ring-attached hydroxyl groups missing in the ephedrine molecule. The absence of these groups probably makes for a more stable molecule, and ephedrine is found to be very stable. Solutions (1-10 per cent) may be boiled without decomposition,⁹ and hence sterilization is easy. Long exposure of ephedrine solutions to light and air does not cause chemical change. Digestive processes do not hinder production by ephedrine, orally administered, of a prolonged peripheral vasoconstriction and bronchial relaxation in most individuals, its most characteristic and useful effects. The greater stability of ephedrine causes its effects to persist longer than those of epinephrine (Figs 1 and 2)

If we glance again at the formula we see that ephedrine has two asymmetric carbon atoms, those marked with asterisks. Hence six possible isomers exist—d—and l—ephedrine, dl—or racemic eph-

Fig 1



Comparison of pressor effect of ephedrine and epinephrine. Dog weight 8.2 kg. Morphine-chloretone anesthesia. Membrane manometer. Ephedrine in 142 times the dose of epinephrine produces less maximum rise of blood pressure on intravenous injection but the rise produced is much longer sustained.

drine, d—and l—pseudoephedrine, and dl— or racemic pseudoephedrine Of these l—ephedrine is the one prepared from Ma Huang, now imported into the United States by the ton for the purpose The supply from this source being inadequate, a synthetic ephedrine, apparently racemic or dl—ephedrine,¹⁰ has been put on the market, and possesses according to Chen¹¹ about 75 per cent of the physiological activity of the l—ephedrine carefully isolated from Ma Huang This indicates that the laenoephedrine has about twice the activity of the dextraephedrine

Ephedrine mixed with about 20 per cent of pseudoephedrine may readily be extracted from Ma Huang⁹ They are mutually convertible by boiling with hydrochloric acid Chou states that the pure base is very soluble in water and alcohol, d—rotatory in the former, l—rotatory in the latter The salts prepared for clinical use are principally the sulphate and hydrochloride, both easily soluble in water, the former difficultly and the latter easily soluble in alcohol (Chou) Solutions of the alkaloid are strongly alkaline, ephedrine under suitable conditions expels ammonia from ammonium salts Pseudoephedrine appears to possess physiological actions similar to those of ephedrine, but is less powerful.¹²

CIRCULATORY EFFECTS

Chen and Schmidt³ confirmed the prolonged rise of blood pressure produced on intravenous injection in the dog The rise appeared due to peripheral vasoconstriction combined with cardiac acceleration produced by stimulation of the sympathetic innervation of the heart, including the stellate ganglia Further details as to the mechanism of this rise in blood pressure will be given later Larger doses were toxic, the heart beat slowed and weakened, the blood pressure reduced The coronary vessels of the heart were not constricted Chen and Meek¹³ showed that small doses intravenously in dogs caused flattening, reversion or augmentation of the T wave in the electrocardiograph, massive doses, frequent disappearance of P waves, bradycardia, prolongation of P-R interval, partial A-V block, nodal rhythm, ventricular escape or extrasystoles, bundle branch block and ventricular fibrillation Cardiac output is generally increased somewhat by non-toxic doses^{13, 54}

Middleton and Chen¹⁴ working with forty-one patients, showed that in man there is an average rise of about 28 mm in the systolic arterial pressure, the onset of the rise occurring in fifteen minutes to two hours after administration, the average being 37½ minutes. Some untoward symptoms were observed with doses larger than 80 mg (1¼ gr), including palpitation, trembling, weakness, sweating, feeling of warmth, or chilliness, nausea, vomiting, dizziness, nervousness, headache, insomnia, dyspnoea, tiredness, thirst, drowsiness. These abated shortly after the blood pressure began to fall, which occurs in one to seven hours after administration. In a few patients no rise of blood pressure was observed. The average duration of the rise was about five hours. The diastolic pressure was also raised. The dose for oral administration advocated was 60–90 mg (1–1½ gr). Extreme caution was recommended in cases of cardiovascular disease or markedly deficient circulation.

A drug of such promise as a circulatory stimulant could not fail to find extensive clinical trial among eager medical experimenters. Some favorable results have been reported in dealing with low blood pressure, principally prophylaxis of this condition in spinal anaesthesia. In other conditions, such as Addison's Disease, reports have not been very favorable.

Rudolf and Graham,¹⁵ of Toronto, used 50–100 mg doses (¾–1½ gr) of ephedrine sulphate in solution, in connection with spinal anaesthesia to maintain the systolic blood pressure always above 110 mm, considering that a fall below this level renders spinal anaesthesia unsafe. Ockerblad and Dillon¹⁶ of Kansas City used ephedrine to maintain a normal systolic blood pressure in spinal anaesthesia in twenty-four cases with uniformly good results. The dose was 100 mg subcutaneously given before the pressure had dropped below 100 mm. Sise¹⁷ recommends 50–100 mg subcutaneously before spinal anaesthesia becomes effective as a prophylactic of low blood pressure, 50 mg intravenously as a remedy.

Rowntree and Brown¹⁸ of the Mayo Clinic found results in Addison's Disease disappointing. Miller¹⁹ reported temporary improvement in two cases, Chen and Schmidt⁸ symptomatic improvement in one case.

Grier Miller of Philadelphia¹⁹ reported in 1925 general physiological effects similar to those of epinephrine, but more prolonged

He used doses of 50–125 mg ($\frac{3}{4}$ –2 gr) There were no definitely harmful effects, a few complaining of palpitation, nervousness or a little nausea "One who had evidence of marked myocardial degeneration showed a transient *pulsus alternans* about one hour after hypodermic injection" Marked temporary improvement was produced in a case of circulatory collapse

Chen²⁰ produced a shock-like rapid fall in blood pressure in dogs under luminal anaesthesia by injection of histamine or peptone, or by anaphylaxis, trauma or rough surgical manipulations He obtained conspicuous circulatory improvement by intravenous injection of 1–3 mg ephedrine per kg He says, "Clinical use can probably be made in the early stage and in mild forms of shock, or as a prophylactic drug against surgical shock in long operations"²¹ Chen and Schmidt (1926) say, "Experimental evidence indicates that ephedrine, injected intravenously in profound shock of thirty minutes or more duration may cause cardiac failure,"²² but add that no such case has so far been observed In their first communication³ they reported that "in one patient in moderate shock following a surgical operation, intramuscular injection of 40 mg ($\frac{2}{3}$ gr) ephedrine raised systolic blood pressure to normal and recovery was prompt and immediate"

It appears possible that ephedrine may be of value as an emergency stimulant in acute morphine or scopolamine (hyoscyne) poisoning Kreitmair²³ induced low blood pressure and failure of respiration in cats by an overdose of scopolamine intravenously He found that adequate intravenous dosage with synthetic ephedrine now caused rise of blood pressure to normal, with resumption of breathing Chen¹¹ has obtained similar results in acute morphine poisoning in cats

A favorable result was obtained by Stecher²⁴ in the treatment of one patient with Stokes-Adams Disease In a case of complete heart block with syncope and convulsions, which were not effectively interrupted nor controlled by epinephrine nor barium chloride, complete relief was obtained during three weeks of treatment by oral administration of ephedrine and the improvement persisted for ten weeks afterwards Pulse rate was at first 20–25, later 25–30 per minute Miller¹⁰ had previously reported in a patient with complete

heart block increase in ventricular rate from 38 to 53 following subcutaneous injection of 100 mg ephedrine sulphate. Dissociation of auricles and ventricles remained complete.

Bloedorn and Dickens²⁵ issue a warning that ephedrine is not to be considered a cardiac tonic. A patient with dyspnoea of cardiac origin, mistakenly diagnosed as bronchial asthma, was given 3/8 gr ephedrine b i d for twenty days. During this time he showed increasing cardiac decompensation, but responded well to digitalis treatment later on. Pollak and Robitschek²⁶ were able by daily dosage with ephedrine to raise the blood pressure of a convalescent pneumonia patient from 100 mm to 145 mm but the clinical condition was not good (palpitation, vertigo, etc). They remark "Raising blood pressure and improving the circulation are in no way identical conceptions."

A recent investigation indicates that administration of ephedrine is very probably free from the danger, present in the case of epinephrine injections during or soon after chloroform anaesthesia, of production of irretrievable ventricular fibrillation. La Barre²⁷ was unable to produce ventricular fibrillation in the cat under chloroform by injections of ephedrine even up to 50 mg per kg. This was readily produced by $\frac{1}{4}$ mg of epinephrine under the same conditions.

MECHANISM OF THE RISE IN BLOOD PRESSURE

Both epinephrine and ephedrine produce a rise of blood pressure on intravenous injection, due to combined cardiac stimulation and vasoconstriction. The modes of action are somewhat different. If suitable doses of fluidextract of ergot or of ergotoxine or ergotamine ("Gynergen") be intravenously injected into the cat or dog the constrictor nerve endings of the sympathetic in the arterioles are paralyzed, the dilator endings left unaffected. If now epinephrine be injected it can stimulate only the dilator nerve endings, and a fall of blood pressure results. But ephedrine still causes a rise^{5 28 29} which may possibly be taken to mean that it acts directly on the smooth muscle of the arterioles, or since the rise may be smaller and of less duration than that produced by ephedrine before the injection of ergotamine,²⁸ that ephedrine acts partly on the sympathetic nerve

endings and partly on the muscle itself Chen ⁵⁵ adheres to the view that the action is sympathomimetic, on the ground that ergotamine may not paralyze the sympathetic cardiac accelerator nerves Adrenal stimulation by ephedrine probably plays some part in the rise in blood pressure The rise is less after adrenalectomy ³⁰ and a dog connected by jugular-adrenal vein-anastomosis to a dog into which ephedrine is injected shows a small rise of arterial blood pressure ³¹

EFFECTS ON THE RESPIRATORY TRACT

Ephedrine in the form of an aqueous solution has been used as a nasal spray with considerable success in relieving nasal congestion Its effect appears to be similar to that produced by dripping a 1 per cent solution on the frog's tongue or web Vasoconstriction and paling may here be observed ⁵ Dr Alice H Cook and Dr Otto Willner, formerly of the Peking Union Medical College, first suggested and demonstrated the use of ephedrine as a constrictor in the nasal mucosa ³² A 10 per cent solution of ephedrine sulphate applied to the nasal mucous membrane produced almost immediate shrinkage, and the action was more rapid and complete than is ordinarily the case with 4 per cent cocaine solution Fetterolf and Sponsler ³³ considered that for use in the nose a 5 per cent ephedrine sulphate solution has all the advantages of epinephrine solutions and perhaps none of the disadvantages, such as extreme nasal irritation

Leopold and Miller ³² reported complete temporary relief of seven out of a total of eleven hay fever patients and found oral administration adequate to produce contraction of the nasal mucosa and simpler and more efficient than a spray Summerfield Taylor ³⁴ found a 3 per cent nasal spray or local application beneficial in hay fever, relief lasting in one case as long as seventy-two hours Observation of fifty-five patients during two seasons by Gaarde and Maytum ³⁵ at the Mayo Clinic led them to conclude that ephedrine by mouth (25 mg or 3/8 gr not more than twice a day) produced sufficient symptomatic relief in 75 per cent of the cases to warrant its use by patients with hay fever They considered a 3 per cent solution used as a nasal spray less efficacious Althausen and Schumacher ³⁶ noted that the degree of relief produced by ephedrine in hay fever and asthma diminished after a time in five out of thirty-nine patients

Two others showed disappearance of nausea at first induced by the drug

Anderson and Homan³⁷ used ephedrine hydrochloride in watery solution in the treatment of twenty children with whooping cough. The doses used were $\frac{1}{4}$ gr to children 1 year of age or over, $\frac{1}{8}$ gr to those younger, in six cases once a day at bedtime, in the rest b i d or t i d. Spasmodic cough and vomiting were relieved in eighteen out of twenty cases. "It is our impression that the drug is most useful during the second stage." Marked restlessness occurred in two infants receiving $\frac{1}{8}$ gr night and morning, marked abdominal distress in three cases, relieved by discontinuance of the drug, reappearing on its renewal, apparent suppression of urine for twelve hours in one case, similarly apparently due to the drug, the urine was negative on examination, abdominal pain and discomfort in three cases, thirty to forty-five minutes after administration of the drug, marked sweating and stupor in two cases, marked nasal discharge in one case, nosebleed relieved in another. The blood pressure rise in nine well children in bed following exhibition of $\frac{1}{4}$ gr of the drug did not exceed 12 mm over the highest control figure.

Benefit has been obtained from the administration of the drug in bronchial asthma. Chen and Schmidt³ showed that as with epinephrine the bronchial muscle was relaxed, and the bronchi somewhat more weakly dilated than with epinephrine.

Thomas³⁸ administered ephedrine by mouth to twenty asthmatics and relieved all but three. Complete relief was obtained in thirty to forty minutes, persisting from four to eight hours. One patient taking 35 mg ($\frac{1}{2}$ gr) doses every six hours remaining asthma-free for three weeks, a larger dose 50 mg ($\frac{3}{4}$ gr) caused palpitation and tremor in this case. Headache, nausea, or sweating were occasionally observed in the series. Middleton and Chen¹⁴ treated twenty-five patients with bronchial asthma, controlled attacks in nine, produced improvement in eight, obtained inconclusive or negative results in eight. Balyeat³⁹ found ephedrine of value in sixty-five out of one hundred cases of asthma and hay fever. McPhedran⁴⁰ was able to give complete relief to nine out of twelve patients with asthma associated with chronic bronchitis, but of these nine, "two

could not take the drug, in one case owing to sleeplessness, in the other to the profuse sweating produced "

Gay and Herman⁴¹ found out of one hundred patients with bronchial asthma treated with ephedrine eight who obtained no benefit It was of benefit to some who could not use epinephrine and vice versa They thought it best given at onset of the paroxysm Pollak and Robitschek²⁶ found very efficacious doses of 50 mg ($\frac{3}{4}$ gr) taken at the very beginning of an asthmatic attack.

Munns and Aldrich⁴² using doses of 12-50 mg ($\frac{1}{5}$ - $\frac{3}{4}$ gr) on twenty-two children with bronchial asthma found twelve relieved, four partially relieved, six obtained no apparent beneficial effect Eight out of nine with persistent cough obtained relief of this symptom Four of the children were nauseated, one showed sweating Leopold and Miller,⁸² reporting on fifty-nine cases of asthma and hay fever, stated that all patients in the "reflex nasal group" were given complete temporary relief, 84 per cent of the "allergic group" and only 38 per cent of the "infectious group" Of twenty-two patients with nasal obstruction (3 reflex, 19 allergic) 86 per cent were completely relieved Althausen and Schumacher³⁶ found symptomatic relief to occur in asthmatics in five to thirty minutes with oral administration, in one and one-half to ten minutes by hypodermic administration of ephedrine Epinephrine in one case afforded more complete relief and more quickly (one minute) They encountered nausea, vomiting, nervousness, insomnia or palpitation in 30 per cent of their cases and in 12 per cent such severe discomfort that administration of the drug had to be discontinued

Ephedrine, like epinephrine, temporarily prevents the appearance of positive cutaneous reactions to specific tests for sensitiveness¹

Saxl⁴³ considers ephedrine of value in the treatment of emphysema and chronic bronchitis It has also been recommended in migraine It often relieves nasal congestion in the "common cold "

EFFECTS ON THE KIDNEY

The urine may be increased or diminished as a result of ephedrine administration A transient albuminuria may occur, considered by Starr⁴⁴ to be due to transient renal vasoconstriction and not to intrinsic injury of the kidney Althausen and Schumacher state that in a group of fifteen asthmatic and hay fever patients "several showed

red cells or casts in the urine after being given ephedrine therapy for a short time" ³⁶ Anderson and Homan ³⁷ reported apparent suppression of urine in an infant for twelve hours, urine negative on examination. Miller ¹⁹ stated "in all the clinical cases that have been studied no evidence of disturbance in either the quantity or the character of the urine lasting longer than a few hours has been observed"

OTHER EFFECTS

Carbohydrate Metabolism —The question as to the advisability of administering ephedrine to diabetics lends clinical importance to various investigations of the effect upon the blood sugar level Rudolf and Graham ¹⁵ examined seven fasting patients, two diabetic and five non-diabetic, for the effect of a single dose of 100 mg ($1\frac{1}{2}$ gr) ephedrine sulphate at 9 A.M. Comparison of blood samples taken at 8 30 A.M. and 11 30 A.M. showed in the case of one diabetic and one non-diabetic absolutely no change, in the case of the other diabetic a rise from 251 per cent to 300 per cent, in the case of the other four non-diabetics a rise of 007, 007, 021 and 035 per cent. in the blood sugar Lublin ⁴⁵ reports rises in the blood sugar and in respiratory quotient in human subjects with ephedrine and ephetonin (synthetic ephedrine) which he interprets as showing that these drugs may hinder conversion of carbohydrate into fat. Nitzescu ⁴⁶ obtained much larger rises by ephedrine administration in dogs after a meal of bread and meat than in dogs fasting Pollak and Robitschek ²⁸ noted that the rise in blood sugar occurred "frequently, but not in all cases"

Secretions and Movements of the Alimentary Canal —The effect on the secretions is probably small ⁴⁷ Patients taking barium meals show increased gastric peristalsis in one-half to one minute after an oral dose of ten to twenty drops of 10 per cent ephedrine solution ²⁶ Young and healthy subjects given 0.01 mg ephedrine intravenously show increased gastric contraction, but doses from 0.1 mg to 20 mg cause temporary inhibition ⁴⁸ Prolonged cessation of peristalsis from cardiac orifice to rectum has been reported in the dog ⁴⁹

Uterine Movements —Ephedrine usually produces contraction in the isolated uterus Chen has reported relaxation in the virgin cat uterus ¹¹ Attempts at explaining the results of pharmacological

analysis of the action of ephedrine on the uterus^{28, 29, 50, 56} have not resulted in any general agreement as to the mechanism, whether nerve stimulation or muscular action or partly both

Eye—Two to four per cent solutions of ephedrine hydrochloride, instilled two drops four times at five-minute intervals, produced mydriasis in seven to sixty-seven minutes after the first instillation, usually maximal in forty to sixty minutes and lasting three to five hours, with a brief, slight (0.25–2.5 diopters) cycloplegia, disappearing before the mydriasis ends. The intraocular tension was unchanged over two hours of observation. Solutions are slightly irritating, and may produce headache or nausea⁵¹

Blood Cells—Initial (20–30 minutes) leucopenia and later ($1\frac{1}{2}$ – $2\frac{1}{2}$ hours) leucocytosis have been reported⁵⁷

Erythema, Angioneurotic Edema, Urticaria—Miller¹⁹ found that ephedrine may produce relief of subjective sensations in certain cases of urticaria, but later Leopold and Miller found it to cause severe urticaria in one patient, a physician, necessitating his resumption of epinephrine injections⁵². Althausen and Schumacher³⁶ found it of doubtful benefit in two out of seven patients with urticaria, useless in the other five, and failed to obtain good results with it in three cases of angioneurotic edema

Leprosy—Ephedrine is being tried with some success as an epinephrine substitute in relieving the nerve pains, being thought to cut down the blood supply to the neural lesions, so reducing congestion⁵²

Has Ephedrine Sympathomimetic Action?—The action of ephedrine presents many points of similarity to the effects of sympathetic stimulation. In this sense it is a sympathomimetic drug. No drug is perfectly sympathomimetic, not even epinephrine, for this fails to increase sweat secretion, though the sweat glands are innervated by the sympathetic. Ephedrine rather infrequently causes profuse sweating in man.

TOXICITY

No case of fatal poisoning in man with ephedrine appears to have been reported as yet. The evidence is therefore entirely that from comparative pharmacology. Chen⁵³ found the fatal intravenous dose for rabbits, cats and dogs about 70 mg (65 mg 1 gr)

per kg body weight, but Wilson, Pilcher and Harrison⁵⁴ killed one dog of a series of nine with an intravenous dose of 4 mg per kg. The fatal oral dose in Chen's experiments was about eight times the intravenous. Were these results applicable to a 70 kg (154 lb) man the fatal single dose for him might possibly, in a very susceptible individual, be as low as 0.28 Gm (4 gr) by vein or 2.2 Gm. (32 gr) by mouth, or about 1 Gm (15 gr) subcutaneously. Death occurs by cardiac depression followed at once by respiratory paralysis. Repeated daily administration to white rabbits of 16–25 mg per kilo six times weekly over a period of four weeks did not cause arteriosclerosis, visceral lesions nor acquisition of tolerance to the pressor or mydriatic effects⁵⁵.

DOSAGE

The ordinary oral adult dose is 25–130 mg ($3/8$ –2 gr). Children under one year have been given $1/8$ gr (8 mg) of the hydrochloride orally, which produced in some cases untoward effects⁵⁷. Suppositories would contain about twice the oral dose. Rudolf and Graham¹⁵ have used an intravenous dose of 50 mg ($3/4$ gr).

Mode of Administration—The principal advantage possessed by ephedrine over epinephrine is that the former may be given by mouth. There seems no good reason why ephedrine sulphate or hydrochloride should not be prescribed in vehicles suitable for codeine phosphate and other soluble alkaloidal salts, such as syrup of tolu, aromatic elixir, etc. Ephedrine sulphate or hydrochloride may also be given hypodermically or intravenously. Solutions may be sterilized by boiling.

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THE OVERLOOKED ADVANTAGES OF THE RECTAL AVENUE OF DRUG ADMINISTRATION

A REVIEW OF THE LITERATURE ON SYSTEMIC MEDICATION
PER RECTUM

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THAT active absorption of many pharmacologic agents takes place from the rectum and, in some instances, the therapeutic effects are superior to those following oral administration, has been abundantly proved. Yet the rectal avenue of administering drugs is much neglected in general practice. When the stomach is intolerant of drugs, many physicians think of subcutaneous, intramuscular or intravenous medication as the only alternative. In this respect, they overlook the real advantages of utilizing the rectal route in suitable cases. Furthermore, it has been shown that many drugs ordinarily considered as within the exclusive province of intravenous therapy—arsphenamine for example—may be given per rectum with highly satisfactory results.

In the hope of stimulating a general interest in the possibilities of systemic medication *via* the rectum, I have studied and epitomized the principal articles in the current literature dealing with this subject. These reports, representing the work of many investigators, should be sufficient to prove that certain drugs should be employed by rectum more frequently than is now the case. The subject is one well deserving of more extensive study.

Commenting on the need for accurate investigation with regard to the absorption of drugs from the rectum, Eggleston¹ states that some drugs seem to be taken up from the rectum quite as rapidly and effectively as when given by mouth, others possibly better, but he believes that most of them are more satisfactorily absorbed after oral administration. The suggestion has been made that, as the inferior hemorrhoidal veins empty directly into the inferior vena cava, pharmacologic agents administered by rectum may be effective in smaller dosage, because they avoid passage through the liver. As

Eggleston remarks, this suggestion is worthy of a special investigation, for the liver unquestionably fixes and destroys, or otherwise eliminates, a considerable number of drugs.

The rectum possesses a high degree of absorptive power. As is well known, a considerable amount of nutrition may be given by rectal alimentation in cases in which ordinary feeding by mouth is impossible or undesirable. Clinical observations show that human life may be sustained for weeks by rectal feeding. Kleinberger² mentions a case in which a man was fed exclusively by rectum for seventy days. Vasilescu³ observes that gastric ulcer heals more rapidly when rectal feeding is employed, because no hyperchlorhydria is present in an empty stomach and the latter contracts. Next to conservative technic for the operative procedure, Fantus⁴ considers proctoclysis as second in importance as a life-saver in perforative peritonitis.

When it is desired to spare the stomach and intestines from the action of some irritating drug, rectal administration offers a safe and effective alternative. This situation is perhaps most frequently encountered during the administration of digitalis for cardiac incompetence, when the patient may be badly in need of the drug and still be nauseated on taking it. During pneumonia and other acute fevers, cardiac stimulation may be required, but the stomach be intolerant of digitalis. In children who refuse to swallow disagreeable medicines, and in the insane, one may find it necessary to resort to the rectal route. In cases of acute gastric irritation, it is of course advisable to avoid oral medication as much as possible, any need for systemic medication in such cases may be met better *via* the rectum.

Fantus⁵ points out that, while the usual rectal dose for systemic medication is double that by mouth, an exception must be made in the case of certain alkaloids, particularly strychnine and morphine. The reason is that these drugs are partially destroyed by the liver after oral administration but escape this action by being absorbed into the inferior vena cava *via* the lower hemorrhoidal veins when given by rectum.

DIGITALIS BY RECTUM

A common teaching holds that digitalis produces nausea and vomiting by medullary stimulation. However, this statement is only

partially true, as certain of the ingredients of digitalis preparations have been proved to be locally irritating to the stomach. Another factor to be taken into consideration is that the oral administration of digitalis is sometimes ineffective, particularly when there is portal congestion. These conditions suggest the rectal use of digitalis under appropriate circumstances.

Eichhorst⁶ in 1915 resorted to rectal digitalis therapy in the case of a man, aged fifty-five, with extreme hypertrophy and dilatation of the left ventricle, who had been treated with the drug by mouth with no improvement. The result was surprisingly good and rapid. The twenty-four-hour quantity of urine increased considerably, the œdema disappeared in a few days, dyspnoea subsided and the patient soon recovered his strength. When the enema was discontinued, the symptoms reappeared, when the clysters were resumed, they were again relieved.

According to Heineke, von Noorden⁷ more than thirty years ago gave digitalis by rectum for cardiac œdema. Heineke⁸ concurs with other workers in observing that numerous cases of cardiac decompensation are encountered in which digitalis by mouth is without avail but rectal administration gives prompt relief. Particularly is this true of severe chronic disturbances.

In Cloetta's⁹ opinion, the absorption of digitalis after microclysters, when the rectum is empty, is just as complete as oral administration on an empty stomach. He quotes Eichhorst and also Picot to the effect that, in a number of cases in which digitalis by mouth proved ineffective, the rectal administration of the drug gave definite improvement. The explanation would seem to lie in the fact that, when the liver and mesenteric veins are extremely congested, the absorption of the drug *via* the portal tributaries is impeded, whereas the inferior hemorrhoidal veins are not part of the portal system but empty directly into the inferior vena cava, making the short cut to the heart. The part of the rectum whose veins avoid the liver and take the short cut to the heart extends about 10 cm. above the sphincter ani, and it is presumably from this part that the digitalis in the microclyster is absorbed.

Meyer¹⁰ believes that the rectal administration of digitalis acts in principle like the intravenous route, because it avoids the liver and portal circulation and thus takes the short cut to the heart.

For that reason, he frequently combines the two methods, allowing one to supplement the other. Sometimes it is advisable to give several intravenous injections of digitalis, following this treatment up with the rectal administration of the drug. Meyer¹⁰ believes that the rectal route for digitalis takes precedence of the intravenous under the following circumstances: (1) When the cutaneous veins are unfavorably located and there is edema, (2) when there is danger of thrombosis or embolism, and (3) when there is prolonged hepatic congestion.

Zinn¹¹ has treated fifty cases of cardiac insufficiency with digitalis by rectum, and his favorable results correspond with those of other workers. In some of his cases digitalis by rectum proved beneficial even when intravenous administration had failed.

Zondek¹² treated about twenty cases in which there was a high grade of congestion of the portal circulation with digitalis by rectum. He found that the drug was well absorbed from the rectum, that the necessary dosage was less than that with mouth medication, and that clinical results were excellent even in cases in which oral administration had failed.

Edens¹³ likewise recommends the rectal administration of digitalis in cases in which the oral route is contra-indicated or ineffective. He agrees that, by circumventing the liver and portal circulation, this avenue frequently offers the most direct and efficient way of giving digitalis.

Morin¹⁴ in 1918 gave digalen by rectum in the form of suppositories to twelve patients with cardiac decompensation, in seven, excellent results were obtained. He was able to prove that there is good absorption of the drug from the rectal mucosa.

Levy¹⁵ in 1924 administered digitalis by rectum twenty-six times to nineteen patients with auricular fibrillation and to one patient with ectopic auricular tachycardia. The average time elapsing before a definite effect was noted was two hours and thirty-five minutes. In every instance a desirable therapeutic effect was observed. By röntgenologic study, Levy was able to prove that the clyster finds its way into the distal segments of the sigmoid and is absorbed from this region. He does not believe that most of the digitalis administered by rectum circumvents the portal circulation and the liver.

In experiments on normal cats in 1925, Reinhold¹⁶ found that the pharmacologic effects appear earlier and are more marked after rectal than after oral administration. He attributes this result to the partial destruction of digitalis by hydrochloric acid and the enzymes of the gastro-intestinal tract and also to possible storage of digitalis in the liver.

By means of electrocardiographic tracings, Willius¹⁷ has demonstrated that complete cardiac effects occur after the rectal administration of digitalis, thus confirming the earlier clinical observations.

ARSPHENAMINE BY RECTUM

Trosarelli¹⁸ and also Noeggerath¹⁹ were among the first to attempt the rectal administration of arspenamine. Trosarelli gave salvarsan dissolved in water by rectum, but his results were not satisfactory.

Noeggerath in 1912 attempted the rectal administration of salvarsan, but only in one case. The patient was an infant, six days old, with congenital syphilis. At weekly intervals, 0.1 gm. of salvarsan in 20 c. c. of distilled water was given by rectum. After four treatments, the hemorrhagic diathesis and the purulent paronychia healed completely and inflammation of the cellular tissue disappeared. In experiments by Noeggerath and Reichle,²⁰ reported in 1923, it was possible by a single rectal injection of neosalvarsan to protect mice inoculated with trypanosomes from what would otherwise have been certain death.

Grajewski²¹ in 1919 pointed out the advantages of giving novarsenobenzol by rectum in cases in which the intravenous route is undesirable. It can be easily administered and may well be given to children whose veins are difficult of entry. The action of the drug becomes effective within two hours. The method is safe, and untoward results have not been observed. From his observations in 125 cases, he was convinced that the therapeutic results were equally as good as those following the intravenous administration of the drug.

Mandracchia²² in 1920 administered arspenamine to twenty-five patients in various stages of syphilis, and his results compared favorably with those obtained after the intravenous use of the drug. He believed that the administration of arspenamine by retention

enema should have a definite place in the treatment of syphilis. The relatively slow absorption is an advantage in his opinion. In children and in adults with extremely small veins, requiring dissection, the rectal route would certainly appear preferable to the intravenous

Wright²³ in 1920 reported on the administration of salvarsan by enteroclysis. After a preliminary fast and purgation, he gave from 0.6 to 0.9 gm of salvarsan dissolved in hot normal saline and diluted to from 260 to 320 c.c. He expressed the view that, after rectal administration, the drug passes directly to the liver and is there stored in part, so that the concentration of the therapeutic agent in the blood never reaches the kidney threshold and consequently it is not lost in the urine, as after intravenous administration.

Fortunato²⁴ in 1923 administered neosalvarsan by rectum in three cases of syphilis in children, but a conclusion cannot be drawn from the results of his investigation.

RECTAL USE OF EPINEPHRIN

Epinephrin is undoubtedly effective when administered by rectum and possesses definite therapeutic possibilities. Lesne's²⁵ studies led him to prefer the rectal route to the oral for the administration of epinephrin. He observed that, when introduced by rectum, it remained just as active as if it had been introduced under the skin and explained this phenomenon with the theory that rectal administration allows the drug to escape the hepatic barrier and thus enter the general circulation directly.

As a post-operative measure, Hernandez²⁶ gives a protoclysis containing 30 drops of epinephrin to the pint of saline solution. Good results may also be obtained from this treatment in the infantile diarrhœas, when 3 ounces of normal saline solution containing 5 to 10 drops of epinephrin may be given as a clyster.

Lesne and Baruk²⁷ observed a fall of thirty beats in the pulse-rate, a rise of blood-pressure and the appearance of extrasystoles after the administration of epinephrin by rectum to very young children.

SOME OTHER DRUGS SOMETIMES ADMINISTERED BY RECTUM

We have just touched upon the field of systemic medication *via* the rectum. It is probable that future research will add many

valuable data to this promising subject. It will be of interest, therefore, to mention a few sporadic investigations with drugs other than those already included.

Peskind, Rogoff and Stewart²⁸ in 1924 found insulin given by rectum effective in rabbits, since it produced the characteristic effect on the blood-sugar curve. However, negative results were obtained both in normal and depancreatized dogs. Peskind,²⁹ as the result of his studies, believes that the absorption of insulin from the rectum is possible under the influence of certain reagents but that the degree of absorption is too variable and uncertain in man to permit of rectal administration for clinical purposes.

Following cholecystectomy and cholecystostomy, the use of hexamethylenamin protoclisis has yielded good results in the hands of Amster.³⁰ He believes that the hexamethylenamin, thus administered, has the advantage of acting as an antiseptic in the urinary and alimentary tracts and also in the gall-bladder and biliary passages.

Irving³¹ in 1923 administered synthetic sodium salicylate by rectum in a dosage ranging from 20 to 100 grains in a large series of cases, including 266 ambulatory patients. He found the rectal administration of the drug safe in the hands of an attendant with ordinary intelligence and relatively large doses were well tolerated. This method of administering salicylates is valuable for the purpose of avoiding gastric irritation, so common after giving this drug. Should untoward effects appear at any time, the unabsorbed drug may be removed by means of an enema.

The iodides are therapeutically effective after rectal administration, as was demonstrated by Osborne³² in 1922. However, not more than 25 per cent. of the potassium iodide given by rectum is absorbed with doses up to 10 gm. daily, and severe rectal irritation results when the dose reaches 30 gm. daily. Therefore, the rectal administration of iodides offers no advantages.

CONCLUSIONS

(1) Systemic medication per rectum in the cases of certain drugs offers definite advantages, which have been largely overlooked in general practice.

(2) In some instances, the administration of the therapeutic agent by rectum has a double advantage, that is, the stomach is

protected from irritation and, at the same time, the therapeutic effect is greater

(3) Many observers have obtained highly satisfactory results with digitalis given by rectum. Particularly is this true of cases in which the oral administration causes nausea and of those in which, because of portal congestion and oedema, the drug is largely ineffective by mouth

(4) In infants and older patients with small and inaccessible veins, the rectal administration of arsphenamine and neoarsphenamine offers a useful alternative to the intravenous route

(5) Therapeutic effect has been observed after protoclyses containing epinephrin, hexamethylenamin and salicylates, respectively

(6) Insulin by rectum is effective in rabbits but not in depancreatized dogs or in man.

(7) Iodides are absorbed from the rectum, but this route is inferior to the oral with respect to this particular drug

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THE TREATMENT OF BURNS IN THE PRESBYTERIAN HOSPITAL OF PHILADELPHIA

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A STATEMENT of the treatment of burns as carried out in this Hospital divides itself into two parts The treatment of ambulant cases with minor first degree burns, and the treatment of extensive major burns whether of first, second or third degree

The treatment of the ambulant patient with a minor burn consists of First, cleansing the burned area with sterile normal saline solution or 3 per cent. sodium bicarbonate solution, if the burned area has been treated with an oily substance or the part contaminated with grease, ether is used as the cleansing agent Should the burned area be a small second-degree burn, the blisters are not opened during the first twenty-four hours Second, after cleansing, a 5 per cent solution of mercurochrome is applied and the area covered with a sterile boric gauze strip and a sterile dressing applied The patient is seen again in twenty-four hours Blisters are opened if necessary and a second application of 5 per cent mercurochrome solution made and the area covered with gauze strips saturated with boric ointment

The boric ointment gauze prevents the accumulation of dead epithelium and mercurochrome from forming crusts Each time the dressing is removed, the area appears clean of crust formation

The prevention of infection is the most important part in the treatment of burns

The treatment of cases requiring hospital care subdivides itself into three heads the treatment of shock, combating the toxæmia, and the care of the wound

The patient with severe burns is admitted in more or less marked degrees of shock. Shock is combated by

- (a) Rapid yet as small amount of moving as possible
- (b) External heat
- (c) Hot coffee enemata
- (d) Lowering head of bed
- (e) Sufficient narcotic to control the pain

- (f) Intravenous administration of glucose 5 per cent or N S S and in severe cases by blood transfusion

The clothing is removed by cutting it away, never pulling it off the burned areas. If it is adherent, it is allowed to remain until the patient has reacted from shock. The burned areas are then cleansed lightly by pouring warm normal saline solution or 3 per cent bicarbonate of soda solution over the clothing, washing away débris, such as burned clothing. The patient is then placed upon a sterile bed covered with a large cradle, the inside temperature of which is 98° to 100° F.

The most satisfactory heat tent is made by tying a wooden frame to the ends of the bed and stretching muslin bandages between the top rail of the frames, the whole being covered with blankets except the head end where the patient's head is allowed outside the tent. No dressing or bed linen comes in contact with the patient.

The combating of the toxæmia begins at once by forcing fluids and by applying, by means of a spray, the 2½ to 10 per cent solution of tannic acid. The application is repeated as often as hourly until the coagulum has formed. The tannic acid need not be repeated after the coagulum has formed solidly. The toxæmia is combated, as has been stated so many times recently, by the coagulum precipitating the proteins which would otherwise be absorbed. The coagulum is allowed to remain *in situ* until healing is complete unless the burned area becomes infected and pus forms under the coagulum. If pus is seen around the edges, this is evidence of infection deep under the coagulum. Fenestræ are made in the coagulum and a large amount of tannic acid used. If, however, the infection continues and toxæmia is increased, then the coagulum must be removed *in toto*.

This is accomplished by applying a wet dressing of 3 per cent bicarbonate for twenty-four hours or by giving the patient nitrous oxide and oxygen anæsthesia and removing the coagulum surgically. The infection is then controlled by using 1/16th per cent solution of dichloramin T. After the infection is controlled, tannic acid solution is again applied and another coagulum formed. At frequent intervals, the blood chemistry is studied to determine the degree of acidosis or alkalosis and appropriate intravenous therapy instituted.

Antitetanic serum is given in every instance.

The additional care of the wound beyond that mentioned above consists in skin grafting upon the granulating surface. The grafting is only attempted when the wound is clear of infection. The pinch graft and the Thiersch's graft are most commonly used.

The child shown in the accompanying illustration (Frontispiece) has a severe third degree burn involving the left face, neck, abdomen and upper one-third of left thigh.

The coagulum was removed and the wound then treated with 1/16th per cent. dichloramin T. The ultimate result was good.

RESULTS OF RADIOTHERAPY IN MALIGNANT DISEASE *

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IN THE fight against cancer, both collectively and individually, each specialty must make its contribution. It is my aim, therefore, to tell you so far as I am able in this brief time what may be expected from radiotherapy in the treatment of malignant disease, realizing full well the essential cooperation of the other specialties and particularly surgery

In general, the earlier, the more thoroughly, and the more skilfully cancer is treated by radiation therapy, the better will be the results. Radiotherapy is local in its effect, though a considerable area of the body can be treated by radiation, and when the cancer is especially sensitive to radiation, surprising results may sometimes be obtained even when cancer covers a considerable area.

Fortunately, cancer begins as a local disease, and every effort should be made to discover it and treat it at once while it is still a local disease. The more superficial and the less infiltrating cancers yield the best results.

The results to be expected, when the most modern methods of radiotherapy are used, will be discussed according to the region of the body involved.

Cancer of the skin can be recognized in the very earliest stages, and when thoroughly and skilfully treated by local destruction and radiation, practically all should get well. It is my practice to destroy the local lesion first by electro-coagulation and follow with the application of either X-rays or radium. Radium seems to be more effectual locally than the X-rays. Radium is especially useful in the treatment of epithelioma of the eyelids, and about the inner and outer canthi, but the treatment must be complete at the beginning.

* Presented at a combined meeting of the Philadelphia Röntgen Ray Society with the Philadelphia County Medical Society, October 24, 1928

Radium treatment is the best method of conserving the tissues. When possible, we should avoid destruction about the eyelids by electro-coagulation because of the retraction of the lids.

Cancer of the Mouth—*Epithelioma of the lip* can be recognized in its earliest stages. It may begin as a crust, a fissure, a warty growth, or as a fever blister. Therefore, whenever such a lesion lasts more than two weeks cancer should be considered. With such watchfulness the lesion can be successfully treated in the precancerous stage.

It is our custom to surround the lesion by a line of electro-desiccation, then remove a specimen, and destroy the lesion thoroughly, and follow with high voltage X-rays over the mental and submaxillary regions, carrying the radiation effects to the point of "saturation."

Our records show 97 per cent cures in 82 cases of epithelioma of the lip, treated before there were any palpable lymph nodes (Through an oversight, one patient did not receive X-ray treatment over the lymphatics). Radium alone in a more limited experience has given excellent results in our hands, and Martin of Dallas, Texas, has shown brilliant results by X-ray treatment alone. When the disease is far advanced, and the lymph nodes are involved, the outlook is very much more serious and a combination of surgical excision of the glands should be considered. Recently, heavy radium packs have accomplished good results, even when glands are involved.

Cancer of the Tongue—In the operable cases of cancer of the tongue without regional lymph nodes, Forsell, at the Radiumhemmet in Stockholm, has obtained 64 per cent of three-year cures, while Regaud, at the Curie Institute in Paris has obtained 63 per cent of three-year cures in operable cases with radium treatment, and 24 per cent cures counting all of the cases of all types of cancer of the tongue treated. When the regional lymph nodes are involved it is often better to combine surgery with radiation. It should be borne in mind that cancer of the tongue metastasizes very rapidly and is apt to extend to both sides of the neck. The continual movement of the tongue and the rich supply of blood-vessels and lymphatics favor rapid development and distribution. For this reason we always treat both sides of the neck with radium. In our radium treatment we have had some more encouraging results with the highly filtered gamma radiation, even when the lymph nodes are

involved In cancer of the mouth I am thoroughly convinced that radium is more effectual than the X-rays We have treated 109 cases of cancer of the tongue Of these there were 27 primary cases without palpable lymph nodes Of these 86 per cent are clinically well and 55 per cent are well from 4 to 15 years

Cancer of the mouth in general can be recognized early Patients should be urged to get expert medical advice whenever an ulceration does not heal within two weeks Sometimes one only needs to remove the source of irritation, such as a bad tooth, a badly fitting plate, irritation from tobacco, syphilis, etc, to get the patient well I am quite sure that it is bad practice to make repeated applications of a caustic such as nitrate of silver

I believe, that if carcinoma of the mouth is treated thoroughly, with the most modern methods of radiation, 50 per cent should recover, and *when the public can be taught to apply for treatment at the very beginning of trouble*, that 75 per cent should get well. This is a great gain as compared with former records

Buccal cancer is usually a development upon a leukoplakia, or results from repeatedly biting the cheek, and since leukoplakia is generally widespread there may be multiple lesions, or the cancer may develop in other areas after the first cancer has been cured Cancer of the inside of the cheek I am now convinced is best treated by gamma radiation This treatment must be given inside and outside of the cheek, and must include the lymphatics

We have seen 78 cheek cancers, of these 15 were too far advanced for any kind of treatment, leaving 63 cases that may be classified Six cases were in females The alveolar process was involved in 28 cases Of 20 primary cases without palpable lymph nodes, 13 or 65 per cent are living and well. Two cases died of intercurrent disease after two and two and one-half years, which if included would give clinical cures of 75 per cent. In the primary group with glands there were 18 cases of which 11 per cent are clinically well from three to five years

All of these cases should be treated in the stage of leukoplakia. For leukoplakia I have found electro-coagulation the most satisfactory, *but one must be sure that it is only leukoplakia*. It is my practice to remove a specimen, destroy thoroughly and apply radium until the microscopic report shows no malignancy I now avoid

electro-coagulation in cancer of the cheek because the *congestion following partial destruction of carcinoma of the cheek will lead to a rapid extension unless controlled by radiation.*

Carcinoma of the Breast—I would like to urge that we teach all patients to get expert medical advice as soon as possible when any lump develops in the breast and especially if it is *not painful*. If the cancer is confined strictly to the breast, I believe that immediate operation will give the best results, and at this stage should give practically 100 per cent cures. *Unfortunately, the cancer of the breast rarely gets into the surgeon's hands in this stage.*

When the cancer has extended to the *lymph nodes*, in the axilla, I believe that *preliminary radiation without manipulation during two weeks*, followed by operation, will give the best results. If the patient cannot be thoroughly controlled, immediate operation, followed by post-operative irradiation will be better. If the disease has extended to the *supra-clavicular region*, preliminary radiation during two or three months followed by local mastectomy will probably give the best results. In all operated cases for carcinoma of the breast, I believe that post-operative irradiation should be given, beginning, if possible, within a period of two weeks. The value of pre-operative and post-operative X-ray treatment is shown by the experimental work of Murphy and his colleagues,¹ at the Rockefeller Institute, and by Russ and Scott,² in England. They treated tissues in animals and then made inoculations of tumors. Over the irradiated areas, there was distinct evidence of interference of growth of the tumor.

Widmann and I,^{3, 4} have made two analyses of our breast cases, one in 1925 in which we analyzed 801 cases treated between 1900 and 1920, and in September of this year we reviewed an additional

¹ Murphy, Hussey, Nakahara and Sturm "Effect of the Cellular Reaction Induced by X-rays on Cancer Grafts" *J Exp Med*, vol 33, p 299, 1921

² Russ and Scott "The Growth of Tumor Tissues Exposed to X rays and Radium" *The British Jour Radiology* (B.I.R. Section), August, 1927

³ Pfahler and Widmann "Statistical Study of Radiation Therapy of Carcinoma of the Breast." (801 Cases) *Amer J Roent*, vol 14, pp 550-562, Dec. 1925

⁴ Pfahler and Widmann "Statistical Analyses of the Radiation Treatment of Cancer of the Breast on the Basis of the Saturation Technique, 412 cases (1920-1928)" *Proceedings of the Amer Roent Ray Soc*, Kansas City, Sept. 24-28, 1928

412 cases treated since 1920 A summary of our recent paper gives the following

Total number of private cases observed	1086
Radiation used alone in 25% of 412 cases (1920-1928)	6%
Microscopical report "benign" in recurrent cases	5
Applied for treatment of any kind inside of 4 weeks	4%
The average time before treatment in the inoperable cases	23 months
The average duration before operation or X ray treatment was	15 months
The average duration of recurrence before X ray treatment	9 5 months

In the recurrent group, the average time from operation to beginning X-ray treatment was fourteen months (In the previous series, 801 cases, 1900-1920, reported in 1925, this average was sixteen months) This shows that throughout we have dealt almost entirely with advanced cases

In this series 15 cases of inoperable carcinoma became operable and have given an average duration of life of forty-eight months up to the present time. Finney (Keen's surgery) gives the average

STATISTICS OF OPERABLE CASES

	<i>Surgery Alone</i>		<i>Surgery and X-ray</i>	
	Alive 3 years	Alive 5 years	Alive 3 years	Alive 5 years
Cure prior to 1924	28 1%	23 1%	61 8%	35 8%
Cure since 1924	24 0%		73 5%	
Lee	21 0%		40 0%	
Rostock	32 7%		47 5%	
Walther	32 0%		77 0%	
Anschutz	48 0%		60 0%	
Rahm	27 5%		30 0%	
Lehmann	32 0%		55 0%	
Shoute and Orban	42 3%	39 5%	57 0%	44 0%
Schmitz				53 0%
Pfahler and Widmann			75 2%	40 0%
Average	32 0%	31 3%	58 3%	43 2%
<i>Surgery Results</i>				
From 32 Clinics	38 6%	28 8%		

duration of life in untreated cases as twenty-four to twenty-eight months

In 15 primary cases treated by radiation alone 50 per cent were alive over five years



FIG 1—A Mr D H age fifty years August 5 1916 referred by Dr Wm Menah Skin cancer in left temporal region growing ten years This was basal cell in type Many of these cancers in this region are of the squamous cell type and may give rise to metastasis They should never be allowed to go more than a few weeks This one was basal cell in type which accounts for the long duration without loss of life

B August 12 1917 shows the result that can be obtained by electro-coagulation and radiation treatment Still well June 21 1923 five years later



FIG. 2—A Mr E D age fifty years January 2 1922 referred by Dr J F Schamberg Epithelioma growing about the inner canthus and side of the nose eight years Treated by various methods including X-ray and local destruction showing the type of cancer that is not likely to get well by radiation alone on account of the associated fibrosis

B April 10 1922 showing healing except a small crust at the side of the nose following destruction by electro coagulation and X ray treatment Still well May 25 1926



FIG 3—A Mr H S age fifty four years October 31 1913 referred by Dr J R Umstad Epithelioma eight years duration with destruction of the outer table of the skull Had been treated by ultra-violet rays carbon dioxide snow and caustics and X ray treatment. On account of the bone involvement this could not be expected to get well under X-ray treatment alone Radium treatment might have produced a cure

B September 1 1914 showing results after electro-coagulation removal of the inner table of the skull and a plastic operation by Dr M P Warmuth Well November 1 1923



FIG 4—A Mrs S M E age eighty five years June 20 1927 referred by Dr J L Flannigan Basal cell epithelioma growing at the inner canthus fifteen years never treated illustrating the importance of avoiding local destruction by electro coagulation because of the damage to the eyelids

B September 27 1927 showing the results of radium treatment Well to date



FIG 5—A Mr J C age seventy-four years October 7 1920 referred by Dr H E Orndoff Basal cell epithelioma twenty years duration showing invasion of the ethmoid cells and frontal sinuses.

B June 14 1921 showing the results after electro coagulation and radium packs This patient ultimately developed a deep recurrence and died This illustrates the great mistake of allowing the disease to grow so long



FIG 6—A Mr G W February 12 1924 Epithelioma of the lip six months growing in a persistent smoker involving nearly half of the left side of the lower lip associated with metastatic lymph nodes. Section showed squamous carcinoma

B May 26 1924 shows results following immediate local electro-coagulation and X ray treatment over the chin and submaxillary region This lesion remained well and metastatic lymph nodes disappeared The patient returned to the Clinic June 5 1923 with a new lesion on the opposite side of the lower lip The patient had not discontinued smoking The second lesion has recovered Patient is still well



FIG 7—A Mr H J age fifty years November 30 1926 referred by Dr Frank Sheppard Shows an extensive carcinoma involving the entire lip chin and submaxillary regions on both sides an entirely hopeless condition from any form of treatment This lesion began as a simple wart on the lower lip It is the type of cancer of the lip that is most easily cured if treated early This patient had been treated during two years by Christian Science with the results shown Patient had most intense suffering and died January 16 1927



FIG 8—4 Mr F R P age forty three September 26 1927 referred by S Irwin Darnell Shows cancer involving the right lower alveolar process floor of the mouth and the right lower jaw bone associated with metastatic lymph nodes in the right submaxillary and upper cervical region Duration of the disease three months Had been treated unsuccessfully by electro coagulation

B June 9 1928 shows the lesion completely healed and this has remained well to date

C Shows the X-ray picture indicating the destruction of the bone down as far as the anterior dental canal There is also shown by the dotted line the shadow of the outline of the tumor

D November 28 1927 shows no further destruction and healthy remaining bone This case is especially noteworthy because of the healing of the cancer after bone was involved

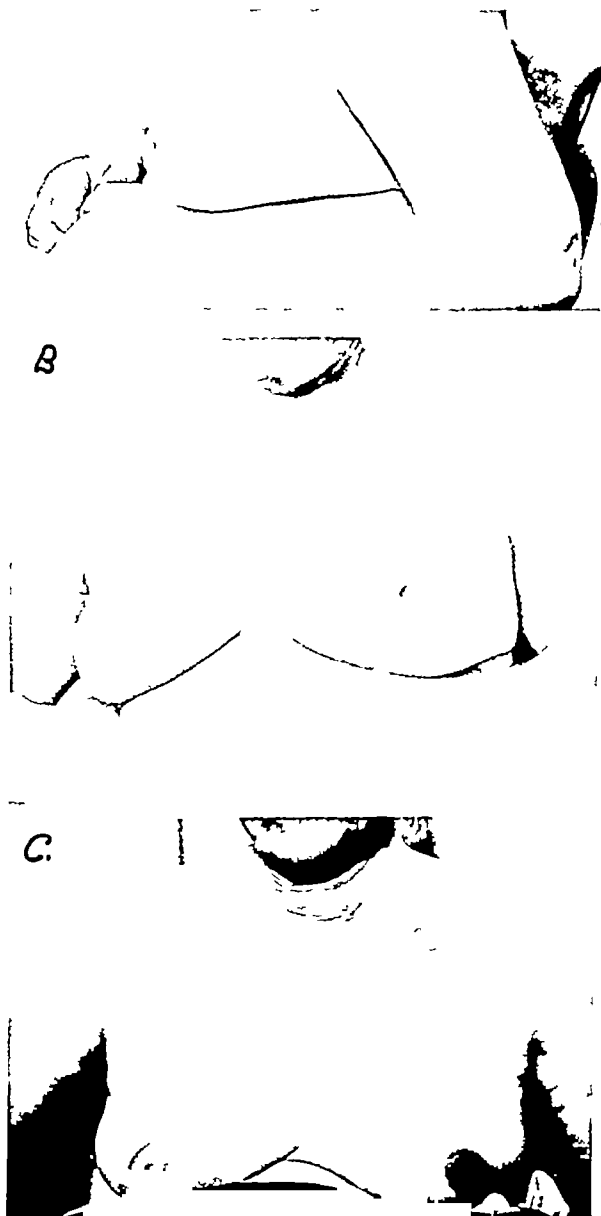


FIG. 9—A and B Miss M. B. age sixty-eight years May 22, 1924, referred by Dr. J. W. Schultz, shows advanced inoperable cancer of the breast. Disease involved the entire breast with lymph nodes in the axilla, and supra-clavicular region. Duration at least six months.

C June 6, 1925, approximately a year afterwards, shows the lesions entirely gone. On June 1, 1927, the patient reported for inspection at which time we found a palpable nodule in the left breast approximately 1 cm. in diameter. I then advised complete removal of the breast which was done by Dr. J. B. Carnett. The patient is now apparently well and is taking care of a thirteen-room house with all the work that it entails. This illustrates the advanced cancer that can sometimes be made operable.



FIG. 10—A July 20 1925 Mrs M McC, age forty seven years, referred by Doctor Zack. Advanced inoperable carcinoma of the breast with fixation and ulceration and extensive metastases ten years duration associated with bone metastasis. See Fig 11
 B September 16 1926 shows a healing of the ulceration as a result of X ray treatment and contraction of the disease fibrous tissue formation and general increased comfort and health of the patient. The patient now after more than three years of comparative comfort is failing. This patient had metastases also in the cranial bones. X ray treatment over the cranial bones on the left side produced complete epilation of the left side of the scalp. The patient's hair had always been straight. When the hair returned after a period of four months this half of the scalp showed curly hair.

A

Nov 13-'25

B
May 7-'26



Fig 11—A Same patient as in Fig 10 November 13 1925 shows extensive destruction by cancer of the left side of the sixth and seventh cervical vertebrae causing complete palsy of the left arm
B May 7 1926 shows recalcification of the diseased area under X ray treatment with re establishment of the use of patient's left arm

In an average of statistics from eleven clinics in which *surgery and radiation* were used there were 58.3 per cent three-year cures and 43.2 per cent five-year cures, as compared with the *surgical results alone* in thirty-two clinics in which there were only 38.6 per cent three-year cures and 28.8 per cent five-year cures. This shows an improvement of 50 per cent in both the three and five year cures as a result of the added radiation treatment.

Cancer of the Uterus—Radiation treatment of cancer of the uterus is now widely accepted as the method of choice. Many statistical studies have been made. Lahm,⁵ in 1925 recorded 2427 cases of carcinoma of the cervix which were followed for at least four years, and obtained a healing percentage of 21.7 per cent. Heyman,⁶ in 1927 published a more critical study on surgical and radiological healing in cancer of the uterus. Out of a total of 3184 patients, who applied for treatment, according to the records there were 543 five-year cures. *This gives an absolute healing percentage of approximately 17 per cent.*

By *absolute percentage of healing* we mean the percentage of five-year cures as compared with the total number of *patients who apply* for treatment whether treated or not and not the percentage of those which are operable or which are accepted for operative treatment. At the Radiumhemmet, among a total of 500 applicants for treatment, an absolute healing of 22.4 per cent was obtained in the cases treated by radiation alone.

The figures for healing of cancer of the cervix uteri by *surgical* methods, as computed by Heyman, on similar principles, from the material of twenty clinics, show an absolute healing of about 18 per cent, namely, 905 cases out of a total of 5024.

While the percentage of absolute cures is nearly the same by these two methods, we must bear in mind that the radiation clinics deal with a more advanced group of cases. Heyman found in the surgical statistics an operability as high as 60 per cent but an average operability of 43 per cent in 17 out of 19 statistics, while *more than half of the radiotherapeutical statistics showed an operability percentage of less than 30 per cent.*

⁵ W. Lahm "Die Strahlenbehandlung des Collin carcinomas," in *Ergebnisse der Med. Strahlenforschung*, vol. 1, George Thieme, Leipzig, 1925.

⁶ James Heyman *Acta Radiologica*, vol. 8, 1927.

In the operable and borderline cases of carcinoma of the cervix, Heyman, in 1927 found in the statistics from twelve clinics, 960 cases with five year cures in 147 cases or a relative percentage of 34.9 per cent as compared with 1303 permanent cures, out of 3659 cases treated surgically giving a relative healing percentage of 35.6 per cent

Seuffert⁷ studied the cases treated in the Doderlein Clinic by surgery before 1912, and by radiation after 1912. I was especially impressed with these statistics because they depend upon the classification made by similar rules and by the same methods, whether surgery or radiation is used.

During the years 1908 to 1912 there were 110 operable cases treated surgically giving 48 per cent of five year cures and between the years 1913 and 1916 there were 77 operable cases treated by radiation with 48 per cent. five year cures, and of those *that completed all the radiation treatment that was advised, 80 per cent were cured*. If the operable and borderline cases are combined during these years there were 167 cases *operated upon with 32.3 per cent cures*. By the same combination of operable and borderline cases *treated by radiation* there were 167 cases treated with a *five year cure of 33.5 per cent*

In a comparative study of cancer of the *body of the uterus*, Heyman found in six clinics a total of 271 cases with 91 that were healed by radiotherapy, five years or more. This gives an *absolute healing percentage* of 33.6 per cent. At the Radiumhemmet, under the direction of Forsell, there is shown an absolute healing percentage of 43.5 per cent or 20 out of 46 cases. The absolute healing percentage by *surgery* from six clinics, was 42.8 per cent (136 healed out of 318 cases). It must be emphasized that in the radiological clinics at least 50 per cent. were inoperable. It would seem, therefore, from these studies that even in carcinoma of the body of the uterus, radiation treatment, when thoroughly and skillfully done, is equal to surgery.

It will be seen, therefore, that by all the analyses, the radiation

⁷ Seuffert. Strahlen Tiefen Therapie und ihre Anwendung in der Gynäkologie, Berlin, p. 482, 1923

treatment gives at least equal results as compared with surgery, and without the operative risks

Cancer within the chest will occasionally yield to radiation treatment, but generally not.

Cancer of the alimentary canal will only rarely yield to radiation alone. Successful treatment at present depends upon the early diagnosis, early operation, assisted probably by post-operative radiation.

Cancer of the pancreas has yielded in a few cases to high voltage X-rays. I have had one case of carcinoma of the *pancreas diagnosed by exploratory operation and found inoperable which has recovered with gamma radiation.*

The Advantages of Radiotherapy

- 1 It is painless in its application.
- 2 It avoids the fear of operation.
- 3 These two factors should lead patients to apply for treatment earlier. Fear of an operation often causes delay.
- 4 Its effects are local, but it can be used over a wider area than surgery.
- 5 There is great conservation of normal tissue.

The Disadvantages of Radiotherapy

- 1 There are fewer trained radiotherapeutists than trained surgeons.
- 2 The treatment is generally more expensive.
- 3 Its effects cannot be seen nor felt immediately, and, therefore, experience and a knowledge of the physics and biological effects are essential.
- 4 Its field of usefulness is limited and it has accomplished little in cancer of the viscera.
- 5 Its invisible immediate effects give it a halo of mystery and this leads patients and some physicians to ascribe almost any symptom to its effect instead of searching for the real cause of obscure symptoms.

FEEDING TECHNIC IN POST-OPERATIVE CASES WHICH ARE COMPLICATED BY PERSISTENT VOMITING

By GEORGE S FOSTER, M D

Surgeon to Lucy Hastings Hospital, Manchester, New Hampshire

OCCASIONALLY we all run across those cases that come to us *in extremis* or very acutely ill with some surgical condition which necessitates immediate operation. In very many of these cases the patient has been below par for some time and has become very neurotic and generally debilitated. It is just this type of case that increases the surgical mortality.

Possibly the majority of these cases have either some intra-abdominal or pelvic pathology which has by contiguity contaminated the peritoneum. It is very well known to all surgeons how very strong the first few post-operative days are. The patient puts up a very good aggressive struggle and on the third day the bowels are moved. Up to this time very little vomiting may have occurred, but when limited liquid nourishment is begun this persistent expulsion of any gastric ingestion commences.

The average patient of this class is already very much weakened and is on the edge of an acidosis. The tissues have become dehydrated and call for lubrication in the form of supersaturation. Microscopically the soft tissue cells of this dehydrated acidosed patient show a typical brown degeneration or severe granular changes. In addition to this the persistent vomiting causes a more marked change in this cellular alteration and something must be done to compensate for the loss of fluids as well as the lack of proper assimilation. In so far as the kidneys, skin and bowels are concerned elimination may be fairly good but of course the urine is concentrated and highly acid, although Nature is attempting to do her part in ameliorating the gastric irritation.

We have found this type of case requires more than ordinary, careful thought and action if we are to be successful in establishing a more comfortable and satisfactory convalescence. With the one thought in mind to overcome the gastric expulsion we have, during

the last few years, developed what we term post-operative feeding technic which we have found to be quite satisfactory in this type of case

In so far as keeping the soft tissue cells fairly well saturated we find that the Murphy drip, saline and glucose axillary sup and the withholding of all water by mouth will generally accomplish the desired end. Locally over the operative field and epigastric areas hot boric fomentations changed every two hours under strict aseptic precautions are a very great aid. Between the changing hours we keep the area superheated with hot water bottles. As far as this is concerned the patient reacts quite favorably but when any nourishment is given by mouth the gastric expulsion resumes.

Our main attention is thus forcibly drawn to the problem of retaining some form of nourishment by mouth. With this as our main objective we have carefully developed a method which we term "The Drop Technic." It has been our main idea to give some form of liquid nourishment such as albumen water, whey, cereal water, malted milk or strained fruit juices, as we have learned that some one of these forms of liquid nourishment serves best in these extreme cases.

This "Drop Technic" is taught every one of our nurses and one of these especially trained nurses is placed on each case as a special nourishment nurse for this special case. Too much stress cannot be made upon this part of the service toward the patient. The average nurse, no matter how painstaking she may be, will not suffice.

The temperature of the nourishment is also a very important part of the procedure. We have found that a temperature of one hundred and five degrees Fahrenheit, seems best and this temperature is maintained by a covered container placed in a water bath.

We use an ordinary medicine dropper for the administration. A food chart is placed on the table beside the patient and a very accurate account kept of all nourishment given, notation being made at the time it is given. This we have found to be a very important factor in stimulating acuteness of attention and exactness on the part of the nurse.

The patient is given one ounce of some one of the above forms of nourishment every hour. By using the medicine dropper, one drop of the nourishment is placed on the back of the tongue once

every five seconds. Thus every minute the patient gets twelve drops of nourishment and the ounce is fully ingested in approximately forty minutes. This permits of a twenty minute rest out of every hour thus allowing some freedom from disturbance to the patient.

Promptly at the end of the first hour the second ounce of injection is begun and continued for another forty minutes giving one drop every five seconds. It has been found quite satisfactory to change the form of nourishment each hour, thus giving the patient a chance to develop a variation in taste resulting in a more satisfactory desire to retain the nourishment given. Again we have found that at times in the place of hour intervals we inaugurate the forty minute interval. That is to mean that an ounce of nourishment is given over a forty minute period and then giving the patient a like period for sleep, rest and digestion. This we have found will work well in the extremely nervous patient when rest or slumber is a prerequisite for success.

Too much stress cannot be laid upon strict adherence to this technic. It must also be remembered that co-administration of the Murphy drip, saline and glucose axillary sup and boric fomentations to the field of operation and epigastrium, are also very important measures. Too much attention cannot be given to these points and the fact that it requires the services of an especially trained nurse giving all of her time to this one case. We believe that we have saved lives, in not a few instances, by the institution of this technic.

There are a certain number of these cases in which we believe reverse peristalsis plays a very important part. In such instances we give one c c of pituitrin every two hours for three doses. We have thought that this has worked favorably in passing over the peak of the crisis.

These gastric expulsion cases are vitally sick. This is the more pronounced because of the fact that the expulsion cycle seems to come about the third day. It is imperative that the bowels be moved with as little mucous membrane irritation as possible.

These patients enter the hospital *in extremis*. Their own power to come back is nearly exhausted. For this reason they require very emphatic active support. The attempt is made to lower the physical exertion of the patient to a minimum. No unnecessary muscular

THE MODERN PHYSICIAN'S ARMAMENTARIUM *

By SOLOMON SOLIS COHEN, M D

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THE simplest living organism is a complex, electrochemical engine, it differs from man-made machines in many things—chief of which are the powers of self-preservation, of self-repair, of reproduction. Progressively higher forms add complexity to complexity, until in the higher vertebrates, and especially in man, new factors are added, difficult to characterize, because imperfectly known and not at all understood—the so-called psychic factors—emotion and mentality. It is unnecessary here to elaborate our ignorance concerning these, whether as to their nature or as to their causation. But we must recognize the part they play both in the derangement and in the restoration of functional activities, perhaps, also, of structural conditions.

In health, the living organism is able to fend for itself, and, granted the presence of the necessary material, can maintain its integrity of structure and its efficiency of function. It responds in certain well organized ways to the changing stimuli of the environment, and how complex this environment is and how manifold the variety of the responses thereto that characterize—if they do not constitute—life, we are just beginning to suspect. Moreover, among the various portions of the organism—even among various portions or phases of individual cells—there goes on a continuous process of adjustment and readjustment, the harmony and sufficiency of which constitute the physiologic balance, in other words, health itself.

Disease presents an altered situation. The living being has become deranged—partially disorganized. It is evident that the native powers of adjustment and adaptation have not been sufficient to meet promptly some untoward change in the environment, or that there has been failure or perversion of internal actions and reactions,

* Read, by invitation, before the American Therapeutic Society, June, 1928, in a symposium on The Teaching of Therapeutics

or that there are present both orders of maladjustment—the ecologic and the intrinsic

In some instances, the disturbed organism, left to itself, can, in time, overcome the derangements and maladjustments and recover its normal state. In most instances, however,—at least as regards the illnesses of human beings—it must be assisted by outside influences. Thus arises the function of the physician, and the necessity for him to determine what are the influences that should and can be brought to bear, to aid the organism in its struggle to preserve life and to restore health.

The sum total of such influences constitutes the physician's armamentarium, the components whereof are both tangible and intangible. But before resorting to his armory, the physician must know both *what* he intends to do with his weapons, and *why*. Otherwise his choice of arms may be ill-guided.

The processes of readjustment, like those of derangement, are departures from the customary order. They, too, are manifested by disturbances—not only modifications of function, but also changes in structure, certainly changes in the electro-chemical states of the tissues. In other words, disease and recovery are not two, separate, sharply defined and opposing conditions, but one, continuous and integrated process, whose purpose—if we may speak of purpose—is restoration. Phenomena of two orders—those of disorganization and those of reorganization—are presented simultaneously and mingled, and it is necessary to analyze and discriminate if intervention is, in truth, to be aid, and not injury.

At various periods in history, chief stress has been laid upon one or another group of remedial means and measures.

The records of ancient civilizations, no less than the practices of cotemporary savages, and those of the half-educated, as well as those of the totally ignorant, members of modern civilized communities, exhibit a dependence upon incantations, amulets, and other mystic rites and objects, which, if they were or are at all helpful, could or can be so, only through the emotions.

Such abuses of emotional influence, however, should not blind us to the possibilities of its legitimate use. Chorea and Graves's syndrome, to cite but two examples, are evidence that emotional disturbances may be factors in a pathogenesis that may even proceed

beyond the disturbance of function, to the sequential induction of structural change. Hysteria affords evidence of the potency of morbid suggestion—and especially that of autosuggestion. It is possible to reverse the process. Wholesome suggestion and other means of affecting the emotions helpfully (including the encouragement of a patient's attitude of faith in a power higher than man, or of philosophic equanimity in the presence of the cosmic mysteries)—even the silent influence of his own calm and hopeful bearing, are among the therapeutic agents of which the scientific physician may, and should, avail himself.

Folklore, with its legends of miraculous healing and resurrection by means of magic plants, exhibits a transition from mere wizardry to the use of what may be termed material agents of restoration. It is possible that search for the magic herbs of fairy tale led to the primitive knowledge of the powers of certain roots and leaves and barks and blossoms, to alter the condition of the organism. Or it may be that the legends arose from the observation that such functional disturbances as vomiting and purgation, inebriation and stupor, even paralysis and death, might come about through the ingestion, or through the application to a wound, of certain vegetable, mineral or animal substances. At all events, our more refined and exact acquaintance with pharmacodynamic phenomena has developed out of some such crude beginning.

Between the superstitious or empiric practices of the savage "medicine men," and the scientific use of—let us say—digitalis or quinidine in auricular fibrillation, there seems at first glance a great chasm. But when we trace back the history of the use of foxglove, if only so far as the old woman from whom Withering was not ashamed to learn—or the history of Peruvian bark, if only so far as the recovery of the Countess of Chinchon—we shall see a road—a road of gradual progress. Only in their most recent phases do the uses of these agents depend upon the carefully controlled experiments of the laboratory, and even these were foreshadowed by empiric observation—that ineluctable method of "trial and error," which is, after all, the basis of advance in every applied science, and even in the most abstract mathematics.

And what is it, after all, that our present laboratory methods show? Not the intimate changes that drugs induce in the electro-

chemical composition, status, or reactions of the cells, or nerves, or organs, not the reasons for the mutual affinities between drug and tissue that determine digitalis action upon vagus nerve or cardiac muscle, not the nature of the reaction that makes digitalis increase the vagus inhibition and diminish the conductive function of the bundle fibres—but simply that such interferences with function (excitation or inhibition, retardation or acceleration—which are none the less interferences because we choose to study them as “modifications”) do take place under given conditions

It is, of course, a distinct advance to know these facts definitely, but we must not misunderstand the character of the advance. It is not a new order of knowledge, but an amplification and refinement of cruder and more limited knowledge of the same order. The “old woman” knew as well as we do, that to swallow an infusion of foxglove, makes the pulse slower and steadier and stronger, and may increase the output of urine. Pharmacodynamic study and electrocardiography have thrown light upon the physiologic mechanisms of these actions and have thus brought about a more exact application of the drug, but the cause or causes of the effects—the ultimate or even the approximate reasons for them, whether from a physico-chemical or from an electrologic viewpoint—remain unknown. We have observed more minutely, but we have not explained. And we have not explained because the fundamental sciences that underlie physiology—and therefore pathology and therapeutics—have not yet reached the point at which explanation is possible. The key to a part of the mystery will probably be found in the course of the progress of electrochemical and biologic research. But at present we must confess that we have it not.

And so one might go on, concerning alcohol and opium and mercury and strophanthus and strychnine and Epsom salt, and all the other medicaments derived from the crude empiricism of savage or peasant, developed in some instances by the simple empiricism of the housewife, in others by the artistic empiricism of the learned, and finally investigated by the experimentalist, in the more or less refined methods possible at the given stage of scientific progress.

It is true that in the ingeniously builded synthetics used to modify nerve function or to kill infecting and infesting organisms, there is an important change in the order of knowledge, certain chemical

relationships between agents and the objects upon which they are to act have been developed. This is a further step in advance, but it is such, chiefly, because deliberate intent has been substituted for chance in the discovery or invention of the medicaments. The real relation between spirochætes and organic compounds of arsenic, or between nerve cells and aniline derivatives, or between Gram-positive or Gram-negative organisms and certain types of dyes, is as obscure as that between the digitalis bodies and the heart muscle, or between strychnine and the spinal cord. "Tropism" means nothing more understandable than "affinity" or "electivity." They are alike descriptive, and not explanatory, terms.

These facts, trite enough to everyone here, have been stressed for one reason.

There is a recent tendency—come to its culmination, one may trust, in the Tenth Revision of the U S P, and due for recession in the Eleventh Revision—to restrict not alone the student in his days of instruction, but also the physician in the days of his practice, to a certain list of medicinal agents, approved by certain able and learned members of the medical and pharmaceutical professions—in other words, to remove from the medical armory certain weapons that soldiers of the past have found useful, but the mechanism of which is not understood by the generals of the present. It has seemed pertinent to show that neither do the generals—or any one else—understand the mechanism of the weapons that they permit to remain. In this connection, too, we may usefully recall the changes in authoritative, scientific opinion concerning—let us say—cod-liver oil. The vitamins were there, just the same, when *Oleum morrhuae* was said by the learned to possess no virtue beyond that of its fatty constituents, while the unlearned continued to use it for the unnamed virtue that they had observed empirically. The history of ephedrine and that of Chaulmoogra oil may likewise be worth pondering.

That it is best not to overburden the student's memory with information that he will be required to demonstrate at examination is true, but let us skimp the examination, rather than the instruction. Let the student be told what to keep in memory, and what to seek in reference books, but let him know that he must be able to utilize the books.

It is also true that the details of pharmacology and pharmaco-

therapeutics can best be taught by means of selected agents illustrative of groups, but again, let the student realize that there are such groups. Let him be taught how the members of a group differ, and how to select, from among them, the agent best suited for the particular therapeutic end in view at a given time, in an individual case. If we but think of the medicaments useful or necessary in asthma of various types, the numerous personal differences—idiosyncrasies—encountered among the patients, and the changes and adjustments in details of treatment necessary from time to time—whatever the causation and whatever the general or special plan of management adopted in any individual instance—the importance of such teaching becomes immediately apparent.

How agents are to be grouped, what individual drugs best represent the respective groups, and how much is to be taught about the type drug and about the other group members, must be left to each teacher to determine for himself, the tyranny of bureaucratic standardizers—of the advocates of a uniformity fatal to progress—cannot be tolerated. Moreover, it may be found wise to divide the study, assigning certain aspects to one term and others to a different term.

But whatever the required objects of study, the student can be told that beyond them are many useful agents with whose properties and uses it will be well to acquaint himself during his hospital years, so that he may be well equipped with knowledge when he comes to practice independently. Also, let him be told that beyond these agents, too, there are a number which may be termed potentially useful, and concerning which he should, when necessary in the course of practice, seek information. And sometimes that information may come from unexpected sources!

Benjamin Rush said "Never be afraid to learn, even from a quack or an old woman." Paracelsus confessed that he had learned not alone from witches and hangmen and vagabonds, but even from erudite professors. At present, unfortunately, the chief source of therapeutic information for the average practitioner, is the "detail man" or the "literature" of manufacturers.

Now both these postgraduate educational influences are of three kinds—good, bad and indifferent.

Let me not be misunderstood. No one interested in the progress of therapeutics can fail to recognize, or should hesitate to acknowl-

edge, the worthy service rendered, not alone by the scientific spirit of research workers in the laboratories of certain drug manufacturing houses, but also by the enlightened business enterprise of such firms. Without the scientific zeal of the investigators in the commercial laboratories, or without the prospect of legitimate monetary return to the stockholders or proprietors upon the totality of an investment, many items of which must prove vastly unprofitable, many potent remedies—some of daily, some of occasional, use—would not now be at our command. Certainly I do not wish to minimize our debt to these manufacturers.

But there are also manufacturers of another ilk, dealing in secret, or semi-secret, or allegedly secret, preparations, and making extravagant, perhaps wholly false or misleading, statements concerning the properties and uses of their wares. Unless the student has been properly trained, the graduate will not be able to distinguish between the true prophet and the false—between the spokesman of scientific truth and the mouthpiece of cupidity and falsehood. Can such adequate training be presumed unless the value of clinical observation, as well as that of laboratory experiment—and the limitations of experiment, as well as those of observation—have been told and demonstrated? Take *cratægus* for an example. Pharmacodynamic experiments give it but a negative standing. Most pharmacologists assert that it is altogether inert—and we may freely admit that it “has no digitalis action.” Yet no clinician who has observed its aid in holding down the blood pressure (after reduction has been accomplished by other means—say diet and autocondensation),—none who has heard subjects of anginoid and aortitic pains describe the relief it sometimes brings—can concur in the view that it is devoid of virtue. The drug does not always give relief, but this means only that our knowledge of its action is imperfect. We have not learned to discriminate in advance of trial, between the cases in which it will act happily and those in which it will fail. Such imperfection of knowledge should be an incentive to further study, and not to the rejection of a potential aid in the alleviation of suffering.

Perhaps some student who hears this said by his teacher, whether of *cratægus*, or of some other drug useful for an unknown reason, may be stimulated to investigation that will solve the problem.

But emotional influences and drugs do not exhaust the armamentarium of the physician.

The "mesmerism" and "animal magnetism" of two centuries ago were, doubtless, partly fraud and partly suggestion; but in so far as they helped to pave the way for the introduction of certain forms of electrical applications into practical medicine, they were not entirely evil. If, however, one reflects upon the history of electrotherapeutics, recalling how the pioneers were doubted and derided and miscalled, and then observes the present position of electrotherapy and heliotherapy and various forms of phototherapy, he is tempted both to sigh and to smile—to sigh at the ignorant scepticism of a recent past, that mistaking lack of knowledge for science, made unhappy the lives of devoted students and practitioners, and to smile at the no less ignorant credulity of the present, which attributes to influences formerly despised, magical virtues which they do not possess. The lesson is, of course, to use the agencies mentioned and kindred physical methods—hydrotherapy, massage and other manipulations, and so forth—for the good that is in them, and neither to expect impossibilities of any method, nor to condemn it for the failure—or for the harm—that results when it is used inadvisedly.

The term "isopathy" is rarely heard today, and those who, in the past, attempted, by inoculation of pus and viruses, to awaken the self-restorative powers of the organism were hampered by ignorance of pathology and etiology, and thus foredoomed to failure. But with the progress of the science of bacteriology, a method of prophylaxis and treatment that had been developed in the Orient, in a forgotten antiquity, and was refined in the Occident when Jenner substituted cowpox inoculation for that of human smallpox, became capable of scientific study and elaboration. Despite its admitted failures and its many misapplications, active immunization by means of vaccines, bacterins, toxins and other pathogens, with its concomitant measure of passive immunization by means of serums and other anti-body carriers, has become one of the most brilliant illustrations of scientific therapeutics.

It is not beyond possibility that certain agents other than the living pathogens, their substance or their products, may have antigenic properties, or may specifically stimulate certain of the normal defense reactions—as has indeed been demonstrated as to phagocy-

tosis, and is quite probable concerning the febrile reaction induced by the injection of non-specific proteins, and by malarial inoculation in luetic paresis. This is a promising field of investigation, at present almost uncultivated in some of its reaches, and which may perhaps include the empirical observations of the special benefit of certain drugs in certain maladies, not explicable by present pharmacodynamic data.

Allusion has been made to light and to vitamins. Some student of evolution will one day discover what fundamental relationship exists between these; why one may be substituted for the other, why one may enhance the action of the other, why the radiant energy should apparently be transformed into a chemical property, as in certain irradiated substances. Meanwhile their use, although scientifically directed by the results of experimentation, is nevertheless empirical, and only by carefully controlled clinical observation can its advantages and its limitations be demonstrated. The various forms of radio-activity fall into a similar category.

Of the endocrin preparations one can simply repeat what is said of other therapeutic agents. Their use is in part empiric, and in part governed by physiologic data. That the normal endocrin secretions are of tremendous importance is common knowledge. That they play all the parts for which the writers of fiction, in and out of the medical profession, cast them, may, nevertheless, be doubted. These agents are neither to be advocated nor condemned, wholesale, and some of their empiric uses are as well established as are those partially explicable. I say "partially explicable" because even the benefit of thyroid preparations in myxœdema lacks full explanation, when pushed to the ultimate analysis, and I am quite sure that certain theories I once advanced in explanation of the undoubted benefits of thymus and adrenal glands in Graves's syndrome, and of pituitary preparations and of epinephrin in asthma, hay fever, hives and other angioneurotic disturbances, must, at least, be modified considerably. Still, a large body of facts is being accumulated, and may, to a certain extent, be utilized.

But, as said in other instances, while the lack of explanation obviously demands further study, it does not warrant a condemnation of demonstrably useful practice.

Finally, reverting to folklore, let us remind ourselves of the old

Japanese legend of the prince and the fox-wife The prince had saved the fox-wife and her baby from hunters When he became ill with a mysterious ailment, the court physicians announced that only a fox-liver, obtained in a certain magical way, could save him. An old woman appeared at the palace asking to see the prince, and bringing with her, she said, the medicine the physicians had demanded She was admitted, recognized her benefactor, gave him what she described as the liver of her son, and changing into a fox, leaped out the window

Perhaps the prince suffered with pernicious anæmia—and perhaps there are many lessons still to be learned from traditional practices and old fables—if, only, one had the key!

Medicine

THE DANGERS OF CIRCULATORY INSUFFICIENCY IN OBESITY, ESPECIALLY WHEN ASSOCIATED WITH EMPHYSEMA AND BRONCHITIS *

By LEWELLYS F BARKER, M D

Baltimore

FAT people are often very happy, jolly people in early and middle life. But as age advances they are subject to certain special dangers, their later lives are all too often tragic. For they have but little resistance to infection and are bad surgical risks, they become flat-footed and develop static arthropathy of the knees, many of them are also victims of diabetes mellitus, many of them sooner or later suffer from high blood pressure, become atherosclerotic and die of apoplexy, and, finally, in middle or later life, obese persons are subject to dilatation of the heart and to attacks of grave circulatory insufficiency.

The patient before you, to-day, illustrates well one form of circulatory disturbance that is prone to develop in the obese, particularly when the adiposity is associated with emphysema. Under the precipitating influence of an acute respiratory infection this man became orthopneic, cyanotic and oedematous. Through careful treatment in the hospital, here, the infection is dying down and the circulatory functions are improving, but it will be necessary for him, from now on, to live most carefully in order to stave off, even for a time, the dangers to which his heart muscle is exposed. Let me give you a brief résumé of his history, after which I should like to discuss certain of the more interesting features of obesity and of the cardiopathy of the obese.

CASE HISTORY

This patient, John M., aged fifty two, a laborer, entered Ward G of the University Hospital (service of Prof. M. C. Pincoffs), some three weeks ago, complaining of shortness of breath, cough, general weakness and swelling of the ankles.

* Clinic to Physicians at University of Maryland, November 1, 1928

He dates the *onset of the present illness* to a period four weeks before admission when he had what he calls a "fit of coughing," accompanied by a "choking feeling in the chest," and the expectoration of yellowish, stringy sputum. He bought some "cough medicine," which gave no relief. Then he consulted a physician who said he had bronchitis. At this time he suffered from nocturnal paroxysms of coughing at half hour intervals, so that his sleep was greatly disturbed, indeed, he asserts that he was compelled to sit in a chair all night. The cough and mucopurulent expectoration continued, despite treatment, and a month after onset he noticed that his ankles were swollen. He lost his appetite and was very thirsty (onset of the *œdema*). His breathing had become even more labored, and he has had night-sweats and has felt very weak. He consulted a second physician, who told him he had "a bad heart," and advised him to enter this hospital for study and treatment.

On questioning him with regard to his *earlier history*, it was learned that at the age of twenty two he had typhoid fever and in the same year he had a chancre on the penis. When twenty seven years old, he had gonorrhœa without complications. In the same year, while intoxicated, he fell from a horse and apparently suffered from concussion of the brain, as he was unconscious for some eight hours after the trauma. Evidently, one ear-drum was ruptured by the fall, as he bled from his right ear, ever since the accident he has noticed deafness in that ear and, besides, when he blows his nose violently he can feel air come out of the ear. He has always been fat, his average weight for ten years before the present illness being about 250 pounds, though his height is only 5 feet 11 inches. Thus for many years he has been some eighty pounds over calculated ideal weight. He weighed 230 pounds when he was thirty and 192 pounds when he was twenty. For several years he has had to rise from two to four times a night to urinate. For the past six years, too, he has had aches and pains in his knees when he was up and about, owing to these discomforts he gave up active work and "lived a quiet life." Except for occasional constipation and some gaseous eructations, there have been no symptoms referable to the alimentary tract.

About three years ago he had an attack of bronchitis that lasted several weeks, but this was the only respiratory disturbance complained of prior to the present illness.

As to his *habits*, he admits four cups of coffee daily and states that he "drinks home brew in summer though not to excess." He is of the opinion that home brew fumes brought on his present illness!

The *family history*, as first elicited, was not very illuminating. He stated that his mother died at forty five, cause of death unknown, and that his father is living and well. There were eight sibs (five brothers and three sisters). One brother died in infancy, a second died from alcoholism and a third died after he was grown (cause of death not ascertained), two brothers are living and well. Of the sisters, one is living and well, he does not know the cause of death of the other two. On closer inquiry, however, a remarkable history of familial obesity was obtained. Both of his parents, two of his brothers and one of his sisters were all very obese, weighing 200 pounds or more. His uncles and aunts on both sides of the family are said to have been very large people!

The findings on *general physical examinations* (made by Doctor Pincoffs, Doctor Eastland and by the resident physician, Doctor Gill) are characteristic

of circulatory insufficiency developing in an obese, emphysematous patient with recurrent purulent bronchitis. He was semi recumbent, dyspnoëic, cyanotic and weak. The face was flushed. The temperature was 101° on admission, the pulse rate 100, and the respiratory rate 20 to 30. During his stay in the hospital the fever has been remittent in type, varying from 100 to 104° during the first week, since when there has been a fall by lysis to approximately normal temperature, though he still has an occasional rise to 100° and to-day his temperature is 101° again. The pulse rate fell from 100 to 72 and has been regular in force and rhythm, and the respiratory rate is now 20. On admission, there was œdema of the lower extremities and ascites. The obesity was, and, as you see, is extreme. As to the distribution of the subcutaneous fat, there is but little in the distal portion of the extremities, most of it is on the trunk (especially the abdomen) and on the buttocks.

The thorax is of the emphysematous type and the patient is of apoplectic or so-called pyknic habitus (short and thick set, ruddy complexion). There are varicose veins in the lower extremities, but no collateral circulations in the abdomen suggestive of obstruction of either the portal vein or the inferior vena cava. The lymph glands are not enlarged. The blood pressure on admission was low—100 systolic and 60 diastolic, it has risen under treatment to 120 systolic and 80 diastolic.

The tongue was dry and the teeth and gums were ill kept. The finger tips, the lips and the ears were markedly cyanotic. There was some nasal obstruction, the tonsils were small, but looked infected, and there was injection of the pharynx with visible mucus and pus.

There was relatively little expansion of the barrel shaped thorax during respiration despite the dyspnoëa, the breathing being abdominal rather than costal. The dyspnoëa was expiratory rather than inspiratory in type, expiration being distinctly prolonged. Percussion of the chest was difficult, owing to the obesity, but there seemed to be slight impairment of the note at the left base behind. Both dry rhonchi and crackling moist râles were audible all over the chest, characteristic of bronchitis, though the high fever and toxic appearance of the patient were suggestive of the possibility of small focal areas of bronchopneumonia as well.

The apex beat of the heart was neither visible nor palpable. Percussion, though not very reliable in results because of the panniculus, indicated that the relative cardiac dulness extended 6 centimetres to the right and 15 centimetres to the left of the midsternal line, and that the retrosternal dulness was increased. The heart sounds were distant, no murmurs and no pathological accentuations of the sounds were audible. The heart was apparently dislocated into a transverse position, owing to the shoving up of the diaphragm.

The patient is markedly abdominous. No abnormal masses (except the fat) could be palpated. On percussion, there was dulness in the flanks and in the lower abdomen, indicating the presence of fluid in the peritoneal cavity. On movement of the knee joints, crepitus was elicited in both. The deep reflexes were normal, though the pupils were rather sluggish.

Laboratory Tests—Examinations of the urine showed a specific gravity of 1015 to 1030 and reduced urinary output, there was a trace of albumen, a trace of bile, on one occasion a little sugar, a few white and red corpuscles and a few

granular casts There was moderate impairment of renal function (phenol-sulphonaphthalein test)

Examinations of the *blood* revealed a slight secondary anæmia (about 4 million red cells, hæmoglobin 80 per cent) and a slight polymorphonuclear leucocytosis (white count 10,000–11,000, 72 to 75 per cent. polymorphonuclear neutrophil leucocytes)

The Kolmer test of the blood serum was negative and a blood culture made two weeks ago has remained sterile Chemical examinations of the blood showed a sugar content of 99 milligrams per cent. and a non protein nitrogen content of 28 milligrams per cent—both within normal limits

The *sputum* was mucopurulent and was occasionally blood tinged It contained both micrococci and bacilli, but no tubercle bacilli A culture of sputum yielded staphylococci as the predominant organism

X Ray Examinations (Dr H. J. Walton)—Röntgenograms of the *paranasal sinuses* show sinusitis in the frontal, ethmoid and sphenoidal sinuses as well as a suspicious left antrum In the röntgenogram of the *chest*, there are signs of infiltration of the bases of both lungs, clouding of both costophrenic sinuses and considerable thickening of the bronchi on both sides Later, a telorontgenogram is to be made for the determination of the exact size and position of the heart itself In the chest plate taken to-day the heart shadow is rather indistinct, it may be that the body of the heart is obscured by the high diaphragm

Examinations by Specialists—On ophthalmoscopic examination (Dr Friedenwald), the *eye grounds* were found to be normal

On examination of the *nose, throat, and paranasal sinuses* (Dr F. B. Anderson) there was slight deviation of the nasal septum to the left, the mucous membrane of the nose and pharynx was injected and there was slight mucopurulent discharge There was slight tenderness over the left antrum The tonsils, though not large, looked infected, though there were no palpable glands in the neck. The teeth were carious and there was some pyorrhæa alveolaris

DIAGNOSTIC SUMMARY

As in most patients studied by modern methods, we are compelled in this man to make a multidimensional rather than a unidimensional diagnosis The principal features would seem to be the following

- 1 Myocardopathy with dilatation and transverse position of the heart and with signs of circulatory insufficiency (dyspnœa, cyanosis, and œdema)

- 2 Extreme obesity (partly endogenous, partly exogenous in origin)

- 3 Emphysema, chronic bronchitis and recurrent acute purulent bronchitis (and possibly, bronchopneumonia)

- 4 The possibility of incipient diabetes mellitus (because of the transitory glycosuria, though the blood sugar is within normal limits the glucose tolerance curve has still to be determined)

- 5 Nasopharyngitis, paranasal sinusitis, and tonsillitis
- 6 Dental caries and pyorrhœa alveolaris
- 7 Secondary anæmia (hæmoglobin 75 per cent)
- 8 Chronic arthropathy of knees (probably static, possibly infectious in origin)

The diagnostic study is not yet complete. It is desirable still to determine (1) the sugar tolerance curve, (2) the basal metabolic rate and the influence of the ingestion of protein upon this rate, and (3) the presence or absence of significant signs in the electrocardiogram, before we shall have all the data needed for judgment of the functional capacity of the thyroid gland, the hypophysis and of the insulogenic apparatus of the pancreas, as well as of any discoverable changes in the automatic rhythmicity, the excitability, the conduction capacity and the contractile power of the heart muscle.

Because of the typhoid fever thirty years ago and the gaseous indigestion, one might suspect the gall-bladder, but the fever seems to be accounted for by the respiratory infections and the slight bilirubinuria by the passive congestion of the liver. Unless other symptoms and signs should develop referable to the right upper quadrant, I should not deem it necessary further to explore the condition of the gall-bladder.

Again, because of the history of chancre thirty years ago and the somewhat sluggish pupils, one might suspect the continuance of a luetic infection, a matter of importance, if it existed, for the man's myocardium. The Kolmer test was negative, however, and if subsequent Kolmer and Wassermann tests yield negative results, we can I think rule out syphilis. In the absence of signs pointing to the nervous system (except the sluggish pupils), it does not seem necessary to examine the cerebrospinal fluid. Moreover, in one who has been as ill as this patient has been, it is our duty sedulously to avoid the making of any disturbing examinations that could with reason be criticized as being superfluous.

THERAPEUTIC MANAGEMENT OF THE PATIENT

The indications for the treatment in this case are obvious from what I have said regarding the diagnosis. The urgent indications on admission were twofold: (1) the necessity of restoring circulatory sufficiency, and (2) that of combating the acute respiratory infec-

tion Only after these indications had been met could it be worth while to pay much attention to other focal infections, to the secondary anæmia, to the obesity, or to the possible incipient diabetes

Treatment of the Circulatory Insufficiency—*Rest*, as complete as possible, was the first desideratum. This means rest in bed, though the patient was allowed to assume whatever position in bed was most comfortable to him The Gatch bed, now commonly available in hospitals, is helpful for the maintenance of various positions by the patient without strain to him If you have no Gatch bed, you can, at any rate, provide a comfortable back-rest Helpful, too, for the resting of the patient is devoted attention by the nurses and orderlies, they feed him, sponge him, lift him, turn him and provide for micturition and defecation in urinals and bedpans, so that he, himself, makes the least possible exertion, moreover, they conduce to mental rest by their calmness and assurance and by protection from all irritation and strain in the immediate environment One reason why patients with circulatory failure do better in good hospitals than in their own homes lies in the fact that, in the hospitals, bodily and mental rest can be more easily provided for than in private homes

To add to his rest, it was necessary to make him *sleep* Before entrance to the hospital, he had been orthopnœic and had sat up in a chair all night, even his dozes in the chair were interrupted by paroxysms of coughing that recurred almost every half hour An injection of morphine sulphate (one-sixth grain) was administered on admission and repeated at 9 P M It was the sovereign remedy at the beginning of the treatment for it allayed the paroxysms of coughing, diminished discomfort, anxiety and apprehension, and induced sleep It is sometimes necessary and permissible to give it nightly for several nights in cases of circulatory failure with dyspnœa, cough and insomnia, but this patient required only two doses of morphine, since afterward codeine and other sedative measures sufficed

In circulatory insufficiency with chronic passive congestion and general anasarca, it is promotive of rest to the heart to *lessen the fluid-content of the body* by restricting the intake of liquids and by promoting elimination of water through the intestine, the kidneys and the skin Accordingly, the fluid-intake of this patient was

immediately limited to 1500 cubic centimetres in the twenty-four hours, watery stools were ensured by giving a dose of magnesium sulphate in the early morning. The skin was active enough, owing to the night sweats accompanying his acute respiratory infection, and elimination of water through the kidneys was soon increased through the cardiotonic measures that strengthened the contractions of the heart-muscle. Diuresis can also be promoted, if necessary, by the cautious use of theocin or euphyllin. When patients are greatly water-logged from circulatory insufficiency, one can often give great relief at the very beginning of treatment by draining a hydrothorax or a hydroperitoneum by the trocar and also by draining the swollen legs by Southey's tubes. One may also relieve the right side of the heart and the venous engorgement by withdrawal of 500 cubic centimetres of blood from the vein at the bend of the elbow. In this connection the value of novasurol as a diuretic in oedema due to circulatory insufficiency should not be forgotten. When other means fail, the intramuscular injection of one-fourth to one-half cubic centimetre of this drug often starts a lively diuresis. Doses of one cubic centimetre to two cubic centimetres are sometimes given, but it is well to start with smaller doses since the larger ones sometimes set up a gastro-enteritis and, it is believed, may sometimes injure the cells of the liver and kidneys. The diuretic effect of the novasurol seems to be greatly enhanced by administering thirty grains of ammonium chloride, thrice daily before and during the giving of the novasurol. Usually one-half cubic centimetre doses of novasurol given every third day for three or four days will lead quickly to elimination of the excess fluid in the body.

One can further lessen the work of the heart by the use of a rigidly *restricted diet*. In outspoken circulatory insufficiency it has been customary to make use of the Karrell diet for the first four days, this consists of four ounces of milk given every two hours from 7 A.M. to 7 P.M., prohibiting the intake of any solids and of any other liquid for this four-day period. Of course no salt is to be added to the milk. Recently, the Karrell diet has been criticized as lacking certain elements necessary for the body. I do not think that the use of it for four days only could be harmful, but it should not be used over a longer period. One may use in place of it, or after it, a diet devised by Dr F. M. Smith of Iowa City which

consists of fruit juices, purees of vegetables, milk, cream, butter, eggs and cooked cereal, with the addition of a little dextrin-maltose, glucose and lactose. The full details of the diet with simple menus will be found in an article by Smith, Gibson and Ross in the *Journal of the American Medical Association* for June 18, 1927 (pp 1943-1947). This diet has an energy value of 2100 calories and consists of 44 grams of protein, 110 grams of fat, and 222 grams of carbohydrate. The digestibility of the foods, the low salt-content and the easily-available energy of this diet are very advantageous. Of course, after the symptoms of circulatory insufficiency have passed off one need not diet so strictly, still it is well to keep the patient on a so-called "cardiac diet" for some time, that is to say, on five small meals rather than three large ones with some restriction of the fluid-intake.

For quick restoration of the functional efficiency of the heart muscle itself, a *standardized digitalis preparation* was given at once, in amounts sufficient to produce physiological effects. One may use any one of a variety of preparations of digitalis, but I think one should grow familiar with one good preparation and use it always. Some will use a good tincture, others will use tablets containing the active principles of the drug. It does not matter, so long as you choose a good preparation and know how to use the one you choose. After compensation of the heart has been established, many patients require a chronic digitalis therapy—say three-quarters of a grain of powdered digitalis leaf in pill form (or the equivalent in some other form) thrice daily after eating for three weeks out of each month.

After convalescence has been well established in this patient it will be important to make his heart as efficient as possible and to maintain the maximal efficiency attainable. Here a difficult task is set us, for it will be necessary outside of the circulatory system itself to give attention to the chronic infectious processes that exist (especially those of the upper respiratory tract), to the reduction of the obesity, and to the management of the chronic bronchitis and the tendency to recurrent acute bronchitis.

The Management of the Infectious Processes in This Patient — Obese persons, as I have said, are very susceptible to, and have poor resistance against, pyogenic infections. This man, as you have heard, has suffered from recurrent bronchitis, from chronic tonsillitis, from

oral sepsis, and from paranasal sinusitis. Fortunately, the measures used in combating the circulatory insufficiency have been valuable also for hastening recovery from the acute bronchitis. The rest in bed and the relief of the cough (first by morphine and later by codeine) led to rapid improvement in the bronchitis and bronchopneumonia, the cardiotonic measures also lessened the chronic passive congestion in the lungs and favored resistance to the infection. Inhalations of compound tincture of benzoin were also used as a palliative measure.

The man's chronic bronchitis has been strongly predisposed to by his pulmonary emphysema. Practically every emphysematous patient suffers more or less from chronic bronchitis. Moreover, both chronic and acute bronchitis are frequently secondary to nasopharyngitis, or to paranasal sinusitis. The treatment of the several foci of infection in the head of this patient will be an important prophylactic measure against the recurrence of acute bronchial and pulmonary inflammation. Time will not permit me to enter upon a discussion of the treatment of these foci. In their management, the general practitioner and the internist must often call the nose and throat specialist to his aid.

The Management of the Obesity in This Patient—It is far easier to prevent obesity than to cure it. What a pity that this man did not in childhood come under the observation and treatment of a good general practitioner who, knowing the obese parents and the stout uncles and aunts, could have warned the child of the predisposition to obesity and have pointed out the great importance of preventing that potentiality from becoming realized! He could have trained the child to suitable habits of eating and exercise that would have been invaluable to him, for such habits would have gone far to prevent his obesity and his present lamentable state. Certainly, exogenous obesity can be prevented, though training of the æsthetic sense and training of the will may be as necessary thereto as advice regarding diet and muscular activity. Endogenous obesity (including the so-called constitutional obesities of endocrine or of regional chromosomal origin) are far more difficult to prevent than are the exogenous forms. But much can be done, even in them, to correct the tendency to which the genotype has so strongly predisposed.

This man has been obese all his adult life. His obesity is due in

part to faulty habits (exogenous) and in part to constitutional make up (endogenous) The distribution of the fat is strongly suggestive of the form of obesity known as hypophyseal obesity Moreover, his sella turcica is seen in the roentgenogram to be of small size Whether or not a hypothyroid factor plays a part can be definitely decided by determining the basal metabolic rate This is always retarded in thyreogenous obesity In hypophyseal obesities, the basal metabolic rate need not be retarded, though the carbohydrate tolerance curve may be abnormal, and the basal metabolic rate is not increased as much as in normal persons after the ingestion of protein I see no evidence of an interrenal factor in the origin of this man's obesity The distribution of the fat, the slight genital hypoplasia, the relative hypotrichosis of the trunk, and the soft thin skin point rather to a hypophyseal insufficiency

This patient's cardiopathy has doubtless been due in part to his obesity There are, doubtless, great masses of fat in his epicardium and in his pericardium, his diaphragm has been shoved upward into the thorax by the fat in his abdomen, and he has been carrying around an extra eighty pounds for decades We know from statistics of life insurance companies the increased mortality rate and the shortened lives of the obese

He is only fifty-two years old, but he is incapacitated and has been for six years! Normally he ought still to have twenty active years ahead of him. He cannot have so many, but let us secure for him what is possible

The diet suited to his circulatory difficulty may lead to some reduction of weight, but we dare not, at present, put him on a diet of too small energy content, we dare not yet make him exercise, we dare not yet give him thyroid extract.

Later on, it may be possible, by diet, by massage and by gradually increased exercise to make him lose weight slowly and steadily while at the same time strengthening him and increasing his resistance to infection Possibly, anterior lobe extract and possibly the cautious administration of thyroid extract may become permissible and helpful later Meanwhile, we must protect him from quack remedies for obesity Some of them are inert, but most of them contain either thyroid extract (which increases oxidation) or purga

phenolphthalein that drive the food out of the intestine before it can be absorbed

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CERTAIN ASPECTS OF IMMUNIZATION IN COMMUNICABLE DISEASES OF CHILDHOOD *

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THE subject of immunization against the diseases of childhood is quite extensive, hence I shall discuss only its more practical aspects, avoiding the mysteries and profundities of the laboratory side of the problem. Contributions to the groundwork of the scientific phases of immunization against this class of complaints have been numerous and noteworthy, but their application in many cases at least too long delayed

HISTORIC

In 1796 Edward Jenner established the principle of protective vaccination by showing that a susceptible person will be protected against an attack of small-pox by the previous successful inoculation with cow-pox. Thus was secured an immunity to variola and it marked the beginning of our modern ideas on immunization, although it had previously been held by the ancients—Hippocrates, Pliny the elder, and others—that the causative factor of a disease was also potent to cure it.

As pointed out by Kolmer,¹ nothing further of importance was accomplished during the next eighty years, or until the first immunization by Pasteur based on the discovery of the specific micro-organism of a virulent intestinal infection of chickens and their complete immunization by the inoculation of attenuated cultures of the causative bacillus. Similarly in 1880 Pasteur immunized animals against anthrax. He next successfully established antirabic vaccination with attenuated virus

Here it should be stated that our knowledge of the defensive reaction of the body cells against an invading micro-organism we owe to Metchnikoff,² who is the author of the story of phagocytosis. In

* Read before a stated meeting at the College of Physicians, May 2, 1928

1896 Fodor³ discovered that the blood of the rabbit will kill anthrax bacilli in the test-tube independent of cells and phagocytosis, and thus was born the humoral theory of immunity. In 1890 Behring and Kitasato discovered antitoxins which, for a time, were held by these and other observers to be of great importance in acquired immunity, but later evidence showed them to be efficient only in diphtheria, tetanus and, subsequently, cholera. It is now known that the phagocytic and humoral theories are fundamentally alike.

DIPHTHERIA

We owe the development of a method of active immunization by means of toxin-antitoxin against diphtheria, to von Behring and his assistants, but Babes in 1895, and at about the same time Park, used it for the purpose of producing antitoxin in animals. In 1907 Theobald Smith⁴ suggested its use for the purpose of producing immunity in man, but it remained for von Behring,⁵ in 1913, to demonstrate the safety of the injections in human beings. Subsequently, Park and Zingher,⁶ who have made wide use of this method of immunization against diphtheria, and numerous other observers have firmly established both the safety and effectiveness of the procedure. Kolmer⁷ states that in his experience 88 per cent of Schick-positive children, three injections have engendered sufficient antitoxin to yield negative Schick reactions on retesting four months later.

There is available a diphtheria toxoid which was prepared by Ramon, and to which the name anotoxin has been given, its use is not attended by complications or with rare exceptions, at all events, according to Lesne⁸ and other observers.

It is true that the accumulated data relative to the value of diphtheria toxin-antitoxin and toxoid-antitoxin in the active immunization against diphtheria establishes the efficacy of this protective device beyond all peradventure of doubt. R. A. O'Brien⁹ has recently pointed out the fact that the use of either toxin-antitoxin or toxoid-antitoxin (Britain) rarely, if ever, produces a condition of "sensitization" sufficient to give rise to serious serum sickness following the injection of serum at a later date.

Despite the fact that this safe and effective immunizing device is quite generally available, it has not been as promptly and as universally utilized as could have been desired. At the present

rate of progress of the crusade against diphtheria, the task of eradicating the disease will be far from completed at the expiration of the five-year period, which it was freely prophesied by certain authorities a few years ago would witness the extermination of the disease. Happily, it may be rightfully claimed that the interval of time between the date of discovery of a scientific fact and its practical application has been steadily growing shorter within recent times.

In this connection data furnished by the Director of Public Health, Dr. A. A. Cairns, is of practical interest. The Philadelphia campaign for the immunization of school children against diphtheria began in May, 1926, and has continued until this year, with the giving of three injections of toxin-antitoxin to pupils as follows:

May, 1926	37,000 (pupils)
September, 1926	80,000
May, 1927	20,000
September, 1927	15,000

152,000 or 58.7% of the pupils

It is also of interest to note that the decrease in the number of diphtheria cases in public-school children is already quite evident, as the following tabulation clearly shows:

	Cases
September, 1924-June, 1925	856
September, 1925-June, 1926	627
September, 1926-June, 1927	493
September, 1927-June, 1928	348 (half school year, 174)

It should be added that the number of minor contagious diseases encountered has been growing smaller each year as community standards of living have improved.

Dr. A. A. Cairns has made careful plans looking to the immunization of the pre-school child of Philadelphia, commencing on June 6, 1928. Starting with pre-natal care the babe will receive attention from its birth or as soon as the certificate of birth is received by the department. A visiting nurse from the Division of Child Hygiene will visit the home and instruct the mother in the proper care of her babe. At the age of six months, the T. A. mixture will be administered and immediately thereafter vaccination against small-pox performed.

There are ten health centres and four leading hospitals at which the pre-school child will be given diphtheria toxin-antitoxin. The Department of Public Health has also entered into an agreement with the Board of Public Education whereby the latter will open seventy public school houses, between the hours of 3 30 and 4 30, to which parents will be urged to bring their children of pre-school age. The physicians in charge of all immunizing stations will be furnished by the Department of Public Health. This is an important step on the part of the Department of Public Health, since it is well known that the younger the child the more susceptible it is to the disease, after six months of age, and also that most fatal cases occur in children under five years of age. Heretofore children at this early period of life have been reached only within quite narrow limits.

Dr William H Park,¹⁰ of the Department of Health, New York City, reports that about 50 per cent of the youngest school children (first four classes) had been injected and about 30 per cent. of the oldest children in the public and parochial schools. He further states that a number of pre-school children immunized by the Department of Health of New York City is only about 4 per cent, and further thinks it could be said that 10 per cent of pre-school children have been immunized by private physicians and Health Department inspectors. In short, the pre-school age has hardly been touched, while only about half of the youngest classes in the primary grades have been immunized. Doctor Park kindly sent a tabulation of 441,000 New York City school children, setting forth the percentage of Schick-positive and Schick-negative cases as shown in table on following page.

The technic of toxin-antitoxin injections as carried out by Dr Walter S Cornell, in Philadelphia, is as follows. A 5 c.c. Luer syringe with a steel slip-on needle of 24-gauge and length three-quarters inch is used. As the dose of the toxin-antitoxin is 1 c.c., the syringe therefore holds sufficient for five injections. The glass barrel is graduated and the physician who is doing a large number of injections simply fills up the syringe, injects 1 c.c. into the first child, the second c.c. into the second child and so on into the third, fourth and fifth. Regarding the sterilization of the needle between injections, we have contented ourselves with the practice of momentarily immersing the syringe in alcohol, wiping it against

some cotton or gauze which is immersed in the alcohol. We cleanse the child's arm immediately before the injection with some alcohol on a pledget of cotton which is at once discarded. The injection is best given intra-muscularly, there being less likelihood of inflammatory reaction than one given hypodermically, although the immunizing result is the same. It is believed that the best site is high on the arm into the body of the deltoid muscle. We have always given these injections in the warm weather in order to encounter the least amount of coincident illness.

441,000 CHILDREN TABULATED AS TO RESULT IN SCHICK TEST

	Schick Positive	Schick Negative	Total No Children Schicked
Under 5	2,483	1,088	3,571
5-6 years	9,427	5,610	15,037
6-7 years	23,857	18,817	42,674
7-8 years	25,664	26,263	51,927
8-9 years	23,509	30,450	54,019
9-10 years	21,338	33,121	54,459
10-11 years	19,070	33,531	52,601
11-12 years	17,206	33,023	50,229
12-13 years	14,484	30,246	44,730
13-14 years	10,728	25,411	36,139
14-15 years	6,219	17,730	23,949
Over 15	3,360	9,227	12,587
	<hr/> 177,405	<hr/> 264,517	<hr/> 441,922

Positive = + and ±

Negative = ± and —

It has been thought unwise to give the toxin-antitoxin in the month of September when infantile paralysis is common, since those making the injections are practically certain to be blamed for any cases of paralysis that may follow the injections. The administration of the toxin-antitoxin consists of three injections of 1 c.c. each, given one week apart.

In the Schick work, a 1 c.c. Luer (glass) syringe of the tuberculin type is used. The material that is obtained from the Bureau of Health Laboratory calls for an administration of one-fifth of a cubic centimetre for a dose. Each loaded syringe therefore suffices for five injections. The diluted toxin in the Schick test is injected intra-dermally, the needle is pushed into the skin very obliquely, care being taken not to pierce through into the subcutaneous tissue.

The needle should be inserted side-wise into the skin, with the bevelled side of the point facing upward, so that the operator can see that the bevelled end is entirely inserted into the skin. Many operators push the needle a little farther in order that the serum will not leak back when the needle is withdrawn, but the farther the needle is pushed, the greater the danger of either getting too deep or having the point of the needle come up to the surface again. The success of the injection is shown by the formation of a visible wheel which is white because of the blanching of the tissue by the introduction of the fluid.

In making this test one must bear in mind the possibility of a pseudo-reaction due to foreign protein. The pseudo-reaction occurs more rapidly than the Schick reaction, being at its height in twenty-four hours and being pretty well faded at the end of forty-eight hours and ordinarily entirely faded at the end of seventy-two hours. On the other hand the true Schick test reaction does not come to its climax for three days and does not fade until about a week after the injection, usually with a pigmentation process long after that time. Schick work is being done only in the first three grades—that is with young children. Because older children are more sensitive to foreign protein, it is the accepted practice when Schick-testing these older children to do a control test using inactivated Schick toxine in the other arm so that accurate information regarding the pseudo-reaction will be at hand.

The clinician cannot afford to ignore the triumphs of the laboratory, but should become sensible of his responsibilities and inform parents of young children of the importance of having them immunized after the age of six months. If he were to appreciate the duty naturally devolving upon him in this respect, he would carry on such instructional efforts zealously and systematically.

True it is that there is on the whole little public demand for this prophylactic service if we except the limited enlightened element of the laity. The lesson of protection against this disease therefore has not as yet been driven home in the majority of homes in which children are popular. The question arises, Cannot the medical profession be justly assailed as neglectful of using its full influence individually and collectively to the end that the task of eradicating

diphtheria may be speedily accomplished through the employment of available means?

This is not the time or place to embark on a full discussion of the practitioner's duty toward a subject of such complexity as immunization in the communicable diseases of childhood, but he should accept facts experimentally proven, that are vitally important to the welfare of mankind, his attitude should be distinctly and actively co-operative in the matter of their practical application

Co-operation between the medical profession and the public is steadily growing closer, chiefly through the efforts of professional organizations and municipal and federal health agencies, as well as civic associations. The chief spur to activity in the work of immunizing childhood against diphtheria has come from public health departments and local boards of health. It would appear that voluntary civic and welfare organizations, like the medical profession, might have been more active in attempts to popularize immunization against diphtheria than they have been in the past.

A further pressing need of the present immunizing campaign against diphtheria is the education and crystallization of public opinion favorable to immediate and universal application of a potent and nonirritating anatoxin. This urgent requirement demands that medical organizations and individual physicians, as well as civic welfare bodies, give their united support to the health departments and local boards of health in a task that is only half-finished, if all children of susceptible ages be considered. Finally, the present situation affords an exceptionally good opportunity to inaugurate such a movement in this direction.

SCARLET FEVER

Historic—In 1923 the Dicks¹¹ found that certain strains of streptococci have a causal relationship to scarlet fever. Gabritschewsky had previously (1907) offered proof in favor of accepting a streptococcus as the specific cause of scarlet fever, but his death prevented him from completing his observations. During the course of further investigations the Dicks made skin tests with standardized toxin and later still produced experimental scarlet fever.

Johan¹² of Hungary Dick-tested about 17,000 individuals, using a control in each case, and immunizing all who gave a positive reac-

tion He found that 53 per cent of all reactions were pseudo-reactions, and further points out that it is difficult to draw a sharp line between weak positive and negative reactions, so that a large number of the former might influence the total percentage of positive reactions In order to reduce the error due to differences in reading the reactions, and the sizes and the degrees of these he etched circles of 10, 20 and 30 mm, thus analyzing his skin tests according to the degree of the reactions Of 1,005 Dick tests 49.5 per cent gave a weakly positive reaction, but this percentage is lower in the first few years of life Johan found that a very high percentage of weak (+) positive reactors could be immunized with a small amount, or a total of 3,000 skin-test doses, while a much larger dose was necessary in the stronger (++) and (+++) positive reactions. The foregoing facts he thinks may explain discrepancies in results obtained by various observers in immunizing with the same dosage Johan tested thirty-eight convalescents and found one positive reactor

Zingher¹³ performed 7,700 skin tests which gave about the same results as Johan's data just quoted.

McEntree's¹⁴ studies lead him to conclude that the Dick skin test is helpful, but not reliable as a guide to diagnosis, although a Dick negative reaction indicates a high degree of antitoxin immunity He states that a polyvalent serum would give a more reliable indication of susceptibility

Kinlade, Smith and Taylor¹⁵ claim that the Dick test is of some value in diagnosis, but the value is limited They continue "The future, however, will undoubtedly see the Dick test in relation to scarlet fever as firmly established as the Schick test is in relation to diphtheria"

Bauer¹⁶ states that the laboratory must work out a more efficient toxin than those available, which cannot be recommended for public use He found the Dick toxin unreliable for immunizing purposes, and ascribes the discrepancies in the results obtained by different observers to lack of uniformity in the standardization of the toxin and antitoxin of scarlet fever Until the Scarlet Fever Commission evolves a method by which toxin and antitoxin may be uniformly standardized, the medical profession will not be justified in urging the general adoption of these agents as means of cure and prevention

Park,¹⁷ of New York City, does not advise immunization against scarlet fever except in localities where it is at the time prevalent or expected to spread, for the reason that children fail to hold their immunity when given even five injections. Diphtheria toxin-antitoxin is slow in acting, but gives lasting results. On the other hand, scarlet-fever immunization is equal in action but not lasting in results. He, however, recommends immunization against scarlet fever in institutions where there are apt to be examples cropping out from time to time and where serum has not only the disadvantage of producing serum sickness but of not lasting more than a couple of weeks. He has had absolutely no accidents from toxin-antitoxin and does not believe that the tiny amount used sensitizes the children to any appreciable degree. It is interesting to note that a shift from horse antitoxin to goat antitoxin has been made in New York City because some people fear the very small amount of horse antitoxin used.

McBrown¹⁸ employed Larson's diphtheria and scarlatina vaccine combined in 955 males and 976 females, giving three injections, one week apart. He states that they do not produce any greater reactions than when given alone, but are effective. G. Ramon¹⁹ also advocates the use of the method of associated vaccinations, it consists of the injection of mixtures of two anatoxins, *e g*, against diphtheria or tetanus, or streptococcus scarlet fever. Mixtures of typhoid vaccine T. A. B. and anatoxin against diphtheria he claims result in a greatly increased antitoxic immunity.

Kinloch, Smith and Taylor²⁰ claim that a potent non-irritating streptococcus anatoxin has been prepared which they believe will profoundly facilitate immunization against scarlet fever. Surely, the newer methods of immunizing when perfected should be applied without delay, but are not being widely employed at this writing. Further steps in the ordered progress of investigation into active immunization against scarlet fever and its serum treatment are awaited with zealous interest.

MEASLES

Tumichiff and Taylor²¹ found that the green-producing diplococcus associated with measles, a disease which occurs only in man, produces an extracellular toxin which gives a definite

in persons with a negative, but not in persons with a positive, history of measles. Further observations will be, however, required before an accurate estimate of the value of their results can be made.

John A. Toomey²² reports on the intramuscular injection of 190 susceptible persons with measles convalescent serum as a prophylactic measure. No serum was given when the history of exposure exceeded six days, and it was obtained from donors eight days after the rash began to disappear. After the injections the susceptible exposures were allowed to come in frequent and close contact with measles cases. Of 190 persons injected, 173 were protected while the remaining seventeen developed attenuated measles.

In the latter part of 1925 at the Contagious and Pediatric division of the Cleveland City Hospital, Babies and Childrens Hospital, and in the private practice of several pediatricians, 199 patients exposed to measles were protected, in only four of whom measles developed. The usual dose of convalescent serum employed was 3 c c.

Dr Samuel Woody, Director of the Philadelphia Hospital for Contagious Diseases, has since 1924 employed convalescent serum, taken about one week after the rash has begun to subside, and found it to be effective. In 1925 during the busiest scarlet fever season this hospital has ever known a measles outbreak of unparalleled proportions occurred in the same wards. To meet the situation with convalescent serum was wholly out of the question, so that instead, whole blood, an ounce or two taken from the parent and injected into the thigh muscles of the patient, was used with success. Parental whole blood and convalescent serum have thus robbed measles of its terrors as a cross-infection. At this writing whole blood is used, since it is more easily obtainable in sufficient quantity. A word of caution should be spoken here. I am strongly of the opinion that the condition known as roseola is sometimes mistaken for measles. So-called German measles, however, must, and as a rule can be, distinguished from true measles.

CHICKEN-POX

Vaccination of exposed varicella patients with the contents of the vesicles has recently been practised, but is not new. Greenthal²³ has had the opportunity of testing the efficacy of varicella vesicle

fluid in checking the spread of this disease and his experiments show that the method is effective. Vaccination should be performed on the first or second day of exposure. He gives minute directions for the procedure, which was employed in thirty-six persons, of which there were nineteen "takes" and sixteen negative reactions. Doubtless some of the patients who gave a negative reaction had had varicella before. It seems to me that the strictest precaution should be taken to avoid the use of vesicle fluid from syphilitic patients. Further experience with a view to confirming active immunization against chicken-pox is needed to determine the value of the method, although on *a priori* grounds it would appear to be most promising. Mitchell and Fletcher²⁴ stress the fact which clinical experience confirms that a considerable number of adults contract this disease.

WHOOPING COUGH

The pioneer discovery in 1906 of Bordet and Gengou²⁵ of the *Bacillus pertussis* has lead others to appreciate the value of bacteriologic methods in the diagnosis of this disease. No concerted effort, however, has been made as yet to immunize children against whooping cough. Certain individual reports give promise of future success, more particularly with convalescent serum, although less successful as a method than in measles. On the other hand, the use of vaccine as a prophylactic and therapeutic measure seems to have fallen into disrepute among certain observers who have had experience of its use during the past few years (Russell²⁶). Huene-kens,²⁷ however, recites evidence from the literature supporting the prophylactic value of pertussis vaccine.

C. J. Bloom²⁸ is enthusiastic about the prophylactic effect of the vaccine in institutions. He found it successful in 304 out of 308 cases immunized against pertussis. His technic is as follows:

"(1) The mixed vaccine is used, each c.c. containing five billion pertussis bacilli and three and five-tenth billion influenza bacilli, (2) this vaccine is given ten days after it has been prepared, (3) 1 c.c. is given on alternate days for three doses, then 1 c.c. every second year if complement fixation test justifies it." It would appear, therefore, that pertussis vaccine is the best instrument available for prophylaxis against whooping cough.

SMALL-POX

With reference to vaccination against small-pox little need be said. The fact that the Philadelphia native population continues year after year practically without any cases of the disease is due to the strict school vaccination law of the State, which has been vigorously enforced by Doctor Cairns, Director of the Department of Public Health, Philadelphia. The division of Medical Inspection of Public Schools carries a memorandum list of some five hundred pupils who are apparently immune to the disease by reason of revaccination annually required. It is quite probable that most of these are successfully vaccinated but their marks have gradually become indistinct.

Cole²⁹ in speaking of the origin of physicians points out that they have been employed by the sick to heal them from earliest times, so that physicians could not be wholly disinterested seekers after truth. Whilst this is still the duty of the medical profession, its members will, in the future, strive to prevent disease and to this end they must become more expert and more zealous in the application of the means of securing artificial immunity against the communicable diseases, particularly of childhood.

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THE PROBLEM OF THE EPILEPSIES

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ALL modern conceptions concerning epilepsy agree in one important particular, namely, that it is not a disease *sui generis*, but a symptom complex due to a large number of causes. So one speaks of "The Epilepsies." In some quarters the term "convulsive state" is used in an attempt to avoid the time-worn word "epilepsy."

While a good deal of value has been learned about the induction of the convulsive state in man and the higher mammals, no external agent is known capable of rendering man or animal subject to *recurrent* spasms. Herein lies the great difference between exogenous convulsogenic agents which produce a *single* series of convulsions and the disease of man with its remarkable tendency to *paroxysmal repetitions* of the convulsive state. When the cause for the recurrency of the attacks is known, a very fundamental understanding of the disease shall have been gained. To determine the cause of this periodic manifestation is the goal of all scientific investigations in this disease.

The main problem, then, is to bring to light the cause of idiopathic epilepsy. Two avenues of research present themselves. One is the study of known convulsogenic agents and conditions in mammals and man. The second is the intensive search for the as yet *unknown* factor operating in the human epileptic. As will be seen, this article is an attempt first, to evaluate the facts now at hand, obtained by both lines of investigation, and second, to find working hypotheses which will be of aid in understanding this complicated subject.

I *Types of Convulsions* By the convulsive state is meant a paroxysmal disorder of clonic or tonic muscle spasm involving larger or smaller segments of the body or even the entire body itself. The resultant movement is an involuntary, disordered, utterly purposeless one, throwing the part, or the entire body, out of normal into an abnormal posture. Whether consciousness is or is not disturbed will depend upon considerations to be discussed later.

In the idiopathic type of convulsive state (*grand mal*), three phases may be recognized in the order of their appearance, first—a fleeting flaccid stage during which the individual falls, second—the tonic phase, third—the clonic phase. Quite rarely the attack may be limited to the initial flaccid stage in which the acute general loss of tone produces sudden “deposturing” or collapse. The tonic stage with unconsciousness is due to suspension of cortical function, and the uninhibited activity of centres in the brain stem. The succeeding clonic phase indicates return of cortical activity, even irritation. The tonic and clonic stages may appear separately in man, and for the sake of clarity will be so considered.

(1) Tonic, and (2) Clonic. The tonic type is often seen succeeding the very transient flaccid stage of the so-called *grand mal* seizure, and is usually generalized. Centres in the brain stem are functionally disconnected from the dominant cerebral cortex, and their uninhibited activity or their isolation results in a decerebrate rigid state. Normally the inhibiting impulses are believed to be mediated by the fronto-ponto-cerebellar pathways (Weed, Warner and Olmstead). The stimuli are transmitted from the brain stem centres to the final common pathway probably along so-called extra-pyramidal pathways. This tonic state consists of a widespread spasm of the extensor muscles. The head is retracted, the back arched, the extremities extended and adducted, the hands are pronated, the fingers are flexed, the feet are in equinus, the jaw is tightly closed (Sherrington,¹ S. A. K. Wilson²). In man the upper extremities are usually flexed, and the head and eyes turned to one side. Consciousness is lost.

The *constant* dilatation and fixity of the pupils, the early pallor succeeded by redness and cyanosis, the *occasional* loss of urine and feces, the salivation and perspiration, are phenomena of the *grand mal* attack referable to the activity of the vegetative nervous system.

The clonic or jacksonian fit is due to irritation of the motor cortex of the brain, the abnormal stimuli are carried by the intact pyramidal tract to the lower motor neurone, thence by way of its final common pathway to the musculature. If the focus of irritation spreads, then adjacent centres in the motor rolandic area are affected in a very regular manner which is conditioned by their well-known anatomical juxtaposition. The movements are interrupted and fre-

quently segmental. When this type of convulsion occurs alone, consciousness is not disturbed, until the movement spreads from one half to the other half of the body.

A spinal and bulbar form of convulsion is best seen in cases of strychnine poisoning, in which there is anarchy in the realm of the lower motor neurones, a tonic extensor spasm is noted, comparable in many respects to the above-described. Consciousness is fully retained.

Analysis of Convulsogenic Factors If one analyzes the many factors involved in the production of the convulsive state, it becomes evident that they may be grouped under one of two headings. *A* Cerebral, *B* Humoral. The experimental work of W. E. Dandy and R. Elman³ illustrates this duality best. If a normal cat be given absinthe by mouth in sufficiently large amounts convulsions will result. This illustrates the operation of a pure humoral exogenous factor. If now one produces a lesion in the cerebrum of the animal, either by simple extirpation of the cortex and sub-cortex, or by simply placing a foreign body beneath the cortex, it is found that one-third to one-seventh the initial dose of absinthe will be convulsogenic one to five months later. By injuring cerebral tissue a cerebral factor is introduced. Table I enumerates the important humoral factors.

TABLE I
Humoral Factors

1 Exogenous	Endogenous
1 Alcohol, lead (absinthe, camphor-monobromate, santonin, picrotoxin, apomorphin, etc.)	1 Uremia.
2 Insulin (anoxæmia ?)	2 Eclampsia
3 Alkalosis (due to hyper ventilation)	3 Endocrine dyscrasias
4 Foreign proteins.	Hormonal Disturbances
	(a.) Parathyroid
	(b.) Thyroid.
	(c.) Pituitary
	(d.) Ovarian
	4. Toxins of the infectious diseases in infants
	5 Spasmophilia.

The Humoral Factors Among them, certain items deserve especial comment. In rare instances the individual may suffer from the convulsive state only when sufficient alcohol is imbibed. Rosett⁴ in

this country and O Foerster⁵ in Germany have drawn attention to the effects of forced over-ventilation of the lungs. In normal persons tetanic features appear. In 55 per cent of epileptics the convulsive state is precipitated. The alkalosis produced by the deep breathing seems in some way responsible for the attacks, possibly through the disturbance of the calcium ion balance in the blood (F Georgi⁶). Fried and Frisch⁷ found an increased blood calcium in these cases. The tetany so induced in normal individuals points to the parathyroid gland and disturbed calcium metabolism. In this connection Geyelin, of New York,⁸ has emphasized the beneficial effects of starvation on those afflicted with convulsions. Work in Cobb's Laboratory in Boston seemed to show that the acidosis accompanying starvation is a factor in this prevention of convulsions. Yet further work discloses that neither acidosis alone nor ketosis alone prevent seizures. Furthermore, studies in the acid-base equilibrium (v 1) show that the formation of endogenous acids seems to be part of the critical physico-chemical change just preceding the convulsion.

In agreement with the recent studies of the German school to be discussed below is the work of the Italian investigator Cuneo,⁹ who believes that there is a disturbance in the starch metabolism resulting in the formation of certain acids (acetic, lactic, butyric, tartaric). Normally the liver and small intestine break these up into urea and sodium carbonate. In epilepsy they are found unoxidized in the urine. Osnato, Killian and their co-workers¹⁰ have found increased lactic acid in the blood and cerebro-spinal fluid of epileptics in the interparoxysmal period. An acidosis results in the presence of which the cellular nucleo-histon bodies split into nucleic acid, and a convulsogenic proteose (the salts of the afore-named acids are also convulsogenic). Donath (quoted by Muskens¹¹) believes that in the convulsive state, alkaloid-ammonium compounds, fragments of normal metabolism, react on a nervous system, the threshold of which has been lowered by either hereditary, or congenital, or toxic, or infectious, or traumatic affections. These compounds are trimethylamin, cholin, kreatinin, guanidine, and ammonium carbonate. Except for the first (trimethylamin) Donath produced convulsions with these agents.

The recent work of Lennox¹² is of especial interest in this connection. He and his co-workers found an increased concentration of

to abnormal protein metabolism and disturbed liver function is suggested by Lennox. He points out that "the liver may have a so-called detoxifying function as shown by the fact that dogs in which an Eck's fistula had been produced when fed meat may have convulsions"

The question of the split products of protein metabolism has been investigated by a number of observers. No unanimity of opinion has been attained. Therapeutically, the results have been disappointing. V. M. Buscaino¹⁸ examined 396 thyroid glands and isolated an abnormal protein from the thyroid of 71 per cent of epileptics. Abderhalden tests with the serum of epileptics reacted positively with the thyroid of epileptics much oftener, and more intensely than with non-epileptic thyroids. In certain cases he regards the convulsion as an anaphylactic crisis.

In the group of endogenous humoral factors, the *endocrine dyscrasias* are of especial interest. The rôle of the parathyroids in the convulsive state of tetany is well known. In three cases of severe epilepsy, O. Foerster⁵ implanted human parathyroid glands. He reports unmistakably beneficial effects on the number and intensity of the convulsive seizures. In regard to the thyroid gland, Buscaino's observations, above-mentioned, are of interest.

Elsberg and Stookey¹⁴ showed that thyroidectomized animals are more susceptible to absinthe in the production of convulsions. The parathyroid glands may also have been injured in their experiments. The foregoing observations lend weight to the belief that the parathyroid and thyroid glands cooperate in rendering innocuous toxic convulsogenic elements (foreign protein split-products ?) in the blood stream (Zabriskie¹⁶).

As regards the pituitary gland, two points deserve mention. One is the frequency of signs of dyspituitarism (acromegalic features, or Frohlich's syndrome) and sella turcica changes demonstrable by X-ray, in the epileptic. The other is the somewhat fanciful hypothesis in which the pituitary gland is believed to enlarge periodically in a sella too small for it. This results in a suspension of function of the posterior lobe which is said to produce an increase of general cortical irritability. The nearby uncinate gyrus is pressed upon and is apt to be the initial "explosive" focus.

Just what rôle the gonads play is difficult to say. During the menstrual period and pregnancy, the seizures are often increased in number and severity.

Concerning the hormones, Frisch¹⁶ classifies them as follows: *a* Those inhibiting the convulsive tendency—parathyroid, pancreas, thymus, gonads and those thyroid hormones that accelerate protein and fat metabolism, *b* Those promoting the convulsive tendency—adrenals and certain hypophyseal hormones and those thyroid hormones which stimulate the sympathetic, the adrenals and sugar metabolism. He refers to the convulsive tendencies of childhood, puberty, menstruation, pregnancy and the climacterium to upheavals in the hormonal status.

Physico-chemical and Metabolic Studies The recent studies of de Crinis,¹⁷ F. Kraus¹⁸ and Felix Frisch, especially the latter's stimulating monograph¹⁸ show the remarkable, dominant part played by humoral processes in the idiopathic convulsive state. Their researches in physio-chemistry (electrolytic and colloidal studies, etc.) reveal new and striking facts which seem to point the way to the final elucidation of the great enigma. I shall attempt a brief analysis of these excellent contributions. Their studies emphasize the findings in the interval or *preparoxysmal* phases of the disease. During the interval period the vegetative nervous system shows a pathological lability, variability and responsivity, with no dominance of vagus or sympathetic innervation. The attack itself is associated with a state of sympathetic dominance.

In the sphere of metabolic activity they demonstrated remarkable findings only disclosed by *serial* studies. Firstly, in the *preparoxysmal* phase, a water and *NaCl* retention were often found (associated, naturally, with oliguria and a gain in the patient's weight). Secondly, rare cases showed the above during the interval period with a relative water-*NaCl* diuresis just before the attack. Thirdly, certain cases showed a retention of *NaCl* without a corresponding water retention in the tissues. The first group is associated with a hypochloremia, the others with markedly variable blood chloride values.

The other electrolytic constituents of the blood show considerable variations. The blood calcium is under normal in the interval, and rises considerably above normal just before the convulsion, as shown by *serial* studies. Potassium values vary greatly with no relation to

the time of the attack Calcium and potassium are antagonists Calcium ion concentration leads to a splitting off of H (acid) ions, potassium to splitting off of OH (alkaline) ions Hence, calcium attracts the acid ions into the blood stream which leads to relative alkalinization of the tissue cells It is interesting to note that relative richness in tissue calcium and magnesium diminishes the convulsive tendency of certain nerve cell aggregations, relative richness in tissue potassium and sodium increases it This coincides with the retention of Na and the withdrawal of tissue calcium in the pre-paroxysmal phase Increased blood calcium has been found in eclampsia (Consoli¹⁹) and during the menses

A disturbance in the acid-base equilibrium is present in epilepsy In the intermediate stages of metabolism endogenous acids appear which disrupt the alkali CO₂ coalition This acidosis is manifested by 1 a reduced CO₂ combining power (de Crinis), 2 a *lessened alkali reserve* (determined by titration), *i.e., hypocapnia*, 3 an increase of the diffusible alkali and a concomitant diminution of the total alkali (Frisch and Walter²⁰), and 4 a "dysregulation" of the NH₃ concentration However, the undisturbed regulatory mechanism of the epileptic prevents any actual change in the blood's reaction

The increased convulsive tendency brought about by hyperventilation is not accompanied by an actual change of the circulating blood to an alkaline reaction

Serial basal metabolism determinations reveal a unique, marked variability in the amounts of oxygen consumed. The variations may reach an amplitude of 40 per cent The values of the specific dynamic action of protein also show similar but less marked fluctuations In 60 per cent of the cases the reaction of the protein addition remains under normal. The nutritional investigations of Kauffmann²¹ and de Crinis¹⁸ show a pre-paroxysmal lessening of oxygen consumption and carbon dioxide production but without parallel curves Carbohydrates, proteins and fats are all involved Consequently variations in the respiratory quotient occur, revealing incomplete oxidation The transient character of the variations is believed to be due to disturbances in the activation of the inactive circulating hormones This is the result of changes in the peripheral autonomic cellular metabolisms and varying impulses emanating from the

central nervous system control. It is significant that acidotic animals show a diminution of oxidative processes (Chvostek).

The serum protein colloid picture of the epileptic shows a characteristic deviation toward phases of high dispersion, which is especially manifest prearoxysmally and during a series of attacks. The amount of the total blood protein is raised, such increase is taken up entirely by the albumin quota. Remarkable variations are encountered here also. The coarse dispersion fraction gives normal values. This deviation to higher dispersion conditions the increased water retention and is associated with the increased calcium content of the blood. The typical blood changes are to be regarded as the "humoral mirror picture" of the tissue changes, *i e.*, an increase of the constituents in the blood is associated with a diminution in the tissue cells, or vice versa.

The lessened nitrogen excretion in the prearoxysmal phase is interpreted as the consequence of the inhibited protein splitting and synthesis at this critical time so that actual nitrogenous intermediate products circulate about, which have no physiological, but rather a toxic, action.

The extraordinary significance of these complex colloidal changes is shown by the fact that drugs producing deviation to the right (high dispersion) excite convulsions and those that provoke a left deviation (coarse dispersion) inhibit seizures.

The residual nitrogen and blood sugar fluctuate but are elevated prearoxysmally. The blood cholesterol is also elevated at this time.

Electrolytic changes, colloidal reactions, hormonal influences, vegetative nervous impulses, play in concert upon the cell's surface (colloidal "membrane") and interior, altering the permeability of the former and the irritability of the entire unit. Hober²² illustrates these complex inter-relationships in the treatment of epilepsy as follows: 1. Sedative therapy erects a narcotic barrier between the cell and its milieu. 2. Withdrawal of NaCl and calcium administration dehydrate the colloidal "membrane" and produce a "condensation barrier." 3. The attack itself "unloosens" the cell so completely that its responsivity to stimuli is much reduced for a considerable period.

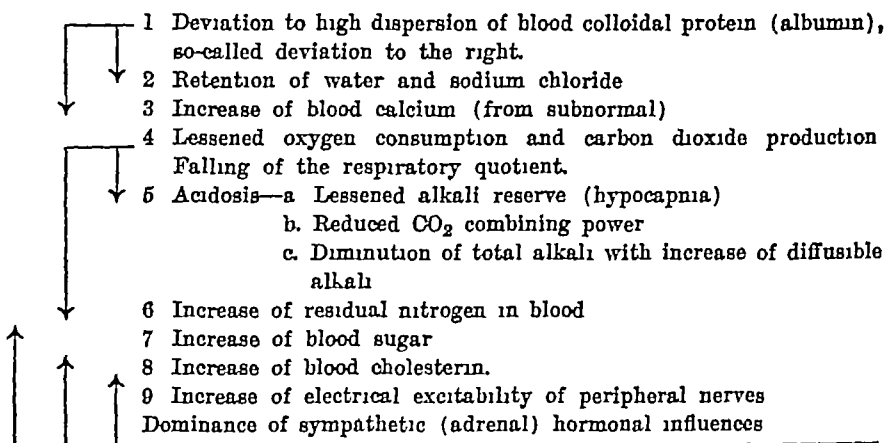
In Table II, the inter-relationship of these important changes is shown. The peculiar heightened dispersion of the " " protein

produces retention of water and increase of calcium. The lessened oxidation permits the appearance of acids (which disrupt the acid-base equilibrium) and causes an increase of the residual nitrogen. The latter may also be, and the increased blood sugar and cholesterol are, attributable to sympathetic hormonal dominance.

As a result of their studies, Kraus and Frisch emphasize the disturbances in the physico-chemical life of the body cells and fluids as the essential disturbance in epilepsy. The remarkable fluctuations present in all the individual physico-chemical processes again reflect the unstable cell-blood exchange. A hereditary constitutional defect (comparable to that seen in diabetes mellitus) must underlie this remarkable disease.

TABLE II

Physico-Chemical changes in the Preparoxysmal period of Epilepsy



In Table III is an enumeration of the cerebral factors

TABLE III

Cerebral Factors

A. Diseases

- 1 Neoplasms (including bony growths)
- 2 Congenital and heredo-degenerative disease
- 3 Degenerations and sclerosis (*viz* multiple sclerosis, tuberous sclerosis, encephalitis periaxialis diffusa, senile cortical atrophy, pre-senile gliosis, etc.)
- 4 Traumatic processes
- 5 Infections and parasitic disease (*viz* lues, tuberculosis, encephalitis, abscess)
- 6 Vascular disease (vascular spasm, arterio-sclerosis, hæmorrhage, emboli)

B Irritants

- 1 Mechanical (*viz* air)
- 2 Electrical
- 3 Thermal
- 4 Chemical (*viz* strychnine painted on the cortex)

C Psychogenic Processes

- 1 Theory of Regression (L Pierce Clark)
- 2 Theory of Rosett The normal epileptoid reaction
- 3 Hysteria.

From the above table it becomes evident that almost all organic cerebral diseases can induce the convulsive state Is it possible to find a single pathological determinant common to all which is the true cerebral factor?

Southard ²³ and later MacRobert ²⁴ in this country and Muskens ¹¹ abroad suggest dysmyelinization as a possible factor A kind of defective insulation of the nervous stimulus results In this connection paroxysmal spasms are rarely encountered in amaurotic familial idiocy, although Hassin ²⁵ stresses the frequent occurrence of decerebrate extensor hypertonus B Sachs ²⁶ does not regard convulsions as an essential part of this disease, in which almost all the ganglion cells of the nervous system degenerate On the other hand, in encephalitis periaxialis diffusa of Schilder, a disease in which the fibre tracts suffer most in a dysmyelinization process, convulsions are frequent Nevertheless, the dysmyelinization theory hardly seems tenable when one considers the important humoral factors It has not been proven by any of the finer anatomical studies, and throws no light on the convulsive state produced by certain vascular conditions to be described

The observations of O Foerster ²⁷ seem to show that in the vascular mechanism of the brain we will find the basic cerebral factor On the operating table he has observed at least one hundred times a preparoxysmal vasoconstriction and anemia of the exposed brain with a diminished volume The tonic convulsion then occurs with a rapid fall of cerebrospinal fluid pressure The removal of cortical function due to the vasoconstriction permits the unbridled or isolated centres in the brain stem to manifest this tonic decerebrate phase, and serves to explain the unconsciousness Then venous stasis comes on rapidly, accompanied by a great increase in brain volume and cerebrospinal fluid pressure. The stasis now produces cortical

irritation and the clonic (jacksonian) phase appears. This vasomotor theory (Nothnagel) explains the sudden onset and cessation of the attacks and the radiation of a jacksonian cortical attack. The sensory aura and the post-paroxysmal weakness may be ascribed to transient loss of function from local anemia.

The following clinical observation is of interest in a discussion of the cerebral vasomotor mechanism.

A young woman of twenty-one years suffered from grand and petit mal and episodes of confusion and excitement over a period of six years. During the petit mal seizures, one of which I witnessed, her face blanched in a remarkable manner. In a second or two the normal facial color was replaced by an extreme whiteness, in a few more seconds the attack was over and the normal ruddiness returned. To see such a striking vasomotor manifestation (in association with momentary dulling of consciousness) convinces one of the important part played by the vasomotor apparatus.

Further weight is lent this vascular basis when we consider the various vascular conditions which are able to provoke the convulsive state.

TABLE IV

Convulsogenic Vascular States

A Disease of Cerebral Blood Vessels

- 1 Arteriosclerosis
- 2 Endarteritis obliterans
- 3 Angiospastic migraine
- 4 Raynaud's Disease
- 5 Aneurisms
- 6 Embolism
- 7 Congenital smallness of carotids or vessels of the Circle of Willis

B Changes in Cerebral Circulation

- 1 Heart block
- 2 Restoration of previously impaired cerebral circulation—
 - A After drowning
 - B After strangulation
 - C After suffocation
- 3 Pressure upon or ligation of carotids and vertebral arteries

Recently more evidence supporting the vasomotor theory is adduced by the work of O. B. Meyer.²⁸ Pieces of cortical arteries show rhythmic spontaneous contractions when placed in normal serum. These can be kymographically reproduced. If the serum of

an epileptic be used the contractions are absent or diminished, this occurred in fifteen out of seventeen cases irrespective of the time (with regard to the paroxysm) of the withdrawal of the serum. In six cases of hyperthyroidism the contractions were increased.

A few years ago MacRobert and Fernier²⁹ explained the frequency of the convulsive state in temporal lobe neoplasms by assuming that the pressure of the tumor interfered with the circulation in the overlying sylvian artery.

Increased cerebrospinal fluid pressure of itself does not cause convulsions, but if other factors are present then such increase will help precipitate the convulsive state (Elsberg and Pike³⁰).

The convulsive state has also been regarded as essentially of psychogenic origin, especially by L. Pierce Clark³¹. Applying the psychoanalytic method, he regards the fit as a regression, a withdrawal from reality into the intrauterine foetal state. There are many objections to this point of view. It does not account for the occurrence of convulsions in deep sleep (which, in itself, is an adequate escape from reality), or the incidence of convulsions in animals of the mammalian phylum, nor does it explain the status type of convulsion with its frequent fatality. This explanation in no way clarifies the convulsive state based on known organic conditions as general paresis, tumor, etc.

The ingenious theory of Rosett³² demands more consideration. He believes that normally, "a stimulus requiring sudden movement on the part of the organism or the narrow focusing of attention, and certain functions such as sleep, defecation, sneezing, coughing, parturition, lead to a temporary reduction or extinction of the cerebral functions." This may lead to a "tonic contraction of the entire skeletal musculature resulting in the posture of decerebrate rigidity."

"The biologic purpose of the reaction is the automatic fixation of the relatively central joints preparatory to any possible needed movement of relatively distal segments of the body and limbs." To its normal incidence he applies the term "normal epileptoid reaction."

This conception may help to explain the tendency of the seizures to appear as the individual is going to sleep or awakening ("Vorzugsmomente" of the German writers), and the very occasional

appearance of convulsions in the beginning of ether or chloroform narcosis (Patch⁸³)

Yet Rosett is not able to explain the reason for the appearance of that periodic, massive, exaggerated response which constitutes the convulsive state. He has contributed some interesting psychological sidelights to the problem.

To discuss the hysterical convulsion would require a consideration of hysteria which would take us too far afield. Obviously its mechanism, though related to, is different from, the convulsive state herein considered.

Heredity Many have emphasized the element of heredity in the convulsive state. In his recent analysis Muskens¹¹ shows that about one-third of his cases had epileptic forbears in the direct and collateral line. About one-eighth revealed insanity in the direct and collateral line. In heredity, alcohol played a part in about one-twentieth of the cases, and lues in only about one-fiftieth. Striking as these figures are, they do not aid us at all in the study of the fundamental causes of the seizures.

"Reflex" Epilepsy Before speaking of the pathology, brief reference may be had to the so-called "reflex" epilepsy, a rather fanciful relic of mediæval medicine. Diseases in the nasal, aural, dental, genital and other spheres were held responsible for the attacks in some mysterious manner. In his analysis of two thousand cases Muskens found no instance of this type. To-day we hear very little of this old myth.

Pathology To describe the investigative efforts expended in the search for the fundamental pathology of epilepsy is to pay tribute to persistent research in the face of almost insuperable obstacles.

To be sure, ganglion cell degeneration, subpial marginal gliosis and other more generalized glioses have been described. Gerstmann³⁴ found atypical and even foetal cells in the molecular cortical layers. Volland³⁵ found regularly karyolytic and degenerative changes in the anterior horn cells in myoclonic epilepsy. A milky, cloudy pia has been the sole finding in cases of focal epilepsy in which biopsies have been obtained (Muskens, *et al*). Alzheimer³⁶ at one time (1898) even went so far as to say that one could regard the epileptic seizure as the result of pressure which the sharply shrunken cortical surface exerts upon the deep cerebral parenchyma.

Yet with the passing of time, a different attitude of mind has been forced upon most observers. This is due to the fact that negative findings have been recorded by careful observers in cases which had neither lasted too long nor been accompanied by mental deficiency or dementia. The general opinion now held is that the pathological changes found are the *result* of the long-enduring process, not the *cause* (Binswanger,³⁷ Zabriskie, *et al*). Hence the idiopathic convulsive state has no essential cerebral pathology. Alzheimer and his pupils believe that the convulsive state is a common attribute of warm-blooded animals, and is to be regarded as a reaction produced by a humoral poison on a nervous system in which lessened tolerance or lowered threshold, has been brought about.

All the facts fit in with the above conception. It permits the study of neural and extraneural factors—the cerebral and the *important* humoral ones. It would seem, then, that the convulsive state is either brought about by (1) a group of poisons operating upon the cerebral vascular mechanism producing vasoconstriction and cerebral anemia, then congestion, or (2) by local cerebral disease or disturbed vascular conditions upsetting the vascular equilibrium or by (3) combinations of the above.

Despite the emphasis now laid on the humoral factors, it must be evident that the cerebral lesions not only determine the type of symptoms produced, but also undermine the natural resistance of the nervous system against the convulsive seizure. Such lesions as *loci minores resistentiae* form part of the vicious cycle.

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UNSUSPECTED RENAL DISEASE IN CHILDHOOD AND EARLY YOUTH

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WE HAVE just celebrated the hundredth anniversary of the work of Richard Bright revealing the connection between albuminous urine and nephritis. For ninety of those years medical thought concerning childhood nephritis was dominated by experiences with the adult types. Previous interest, dating from the writings of Galen and Celsus had been limited to hematuria or bed-wetting, and even as late as the end of the last century Abraham Jacobi taught only the acute accidents of nephritis—anasarca, hematuria, uric acid stone, and uræmia. Previous interest, dating from the time of Galen and Celsus, had been limited to hæmaturia and bed-wetting. In 1908, Heubner¹ described a type of nephritis in early life without vomiting, smoky urine or œdema, discovered only by examination of the urine, which he called "Pædonephritis." Observations in eight children with this form of disease comprise the basis for this paper. Let us illustrate with a few selected case records.

CASE I—M D Y, a boy of 14, was seen in October, 1925. He was referred because of white blotches on his face. He had lost eight pounds in a year, and for some time there had been a stubborn infection of the right maxillary antrum requiring several operations. The past history showed measles, varicella, pertussis and a tonsillectomy. There was no family history of nephritis. Physical examination was negative. The urine had a specific gravity of 1.010, a definite trace of albumin, occasional hyaline casts and a few erythrocytes. Subsequent urinalyses in 1926 showed the same findings. In February, 1927, the sinus infection had been brought under control and the urine was normal.

CASE II—J H, 14, was rejected for life insurance because of albuminuria, in April, 1924. The boy had had measles, mumps and a tonsillectomy in early years. There was no family history of nephritis. On physical examination two infected foci in the tonsillar stumps were the only abnormal findings. The urine had a marked trace of albumin, a number of hyaline and a few light granular casts and a few erythrocytes. Several subsequent weekly urine specimens showed similar findings. Further laboratory studies at the University Hospital were as follows: Blood urea nitrogen 22 mg, blood uric acid 3.8 mg per 100 c.c. Intravenous phthalein was excreted, 45 per cent. the first hour and 5 per cent. the second hour. The twenty four hour output was 840 c.c. Röntgen

serve to differentiate this condition (3) *Cystitic albuminuria* is rare in children There will be a history of frequent painful urination and a mucoid urinary sediment containing a large number of bladder and pus cells without casts (4) *Pyelitic albuminuria* is exceedingly common and often symptomless The diagnosis rests on an abundance of pus cells and no casts in the urine under the microscope

In thinking of treatment we must search out possible foci of infection, and review the family history Both may give us important leads for rational therapy The diet should be bland with enough protein to adequately meet the waste and growth needs of the child A mild restriction of exercise, especially competitive sports, is advisable, otherwise the child should be allowed to lead a normal life Medicinally we have used only Basham's mixture for those cases with a secondary anæmia Clausen,⁴ however, advocates the use of diuretin in every case to raise the blood surface tension to normal

In some instances the albuminuria disappears upon eradication of the focal infection In others there is an inexplicable spontaneous disappearance, making the final prognosis very good, in either event It is well to warn the parents or patients from the start that the process is a slow one, lasting not weeks, but months and in some cases several years, but by exercising a little care and a great deal of patience the urine will eventually clear Our experience has been that albuminuria persists longest, often permanently, in patients with a bad hereditary background and these cases quite frequently progress to a chronic nephritis in later life

My grateful indebtedness is hereby acknowledged to Dr David Riesman with whom I saw most of these patients and from whose office records the patients observed for more than three years have been selected

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Surgery

HORSESHOE KIDNEY WITH A REPORT OF EIGHTEEN CASES

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SINCE the advent of cystoscopy and pyelography, the various renal anomalies have gradually been grouped and classified, and whereas formerly vague and obscure pathological conditions of the kidney were disclosed only at the operating table or post-mortem, at the present time a preoperative diagnosis is usually established. Especially is this true in the case of horseshoe kidney. Until the year 1924 only 108 cases had been reported in the literature, and of this group only twenty-four cases, or 22 per cent, had been diagnosed correctly, prior to surgical intervention, while with our modern facilities a correct preoperative diagnosis can be established in 95 per cent of the cases. In 1927 Kretschmer brought the total series of reported cases up to 136.

Incidence—The incidence of horseshoe kidney varies slightly in the reports of various authors, however, it averages approximately one in every thousand according to figures derived from the operating room and from post-mortem examination.

Various statements have been made as to the frequency with which horseshoe kidney has been found at autopsy. Thus, Carlier and Gerard report one in 852 autopsies, Kuster one in 1,000, Morris one in 1,500, and Young one in 850. Young's figures being based on 68,000 autopsies.

At the Mayo Clinic, among 2,424 cases in which operations were performed on the kidneys, horseshoe kidneys were present in seventeen cases.

There appears to be no report in the literature as to sex incidence, but in our series fifteen of the patients were males and three were females.

Coexisting Pathological Condition—In approximately one of every six cases of horseshoe kidney other pathological conditions are present in the kidneys. Horseshoe kidneys seem predisposed to lithiasis, hydronephrosis, pyonephrosis and tuberculosis.

Rathbun, in reviewing 108 collected cases, noted the following coexisting conditions

Calculi	32	Trauma	2
Hydronephrosis	18	Ureteral calculi	1
Pyonephrosis	11	Adhesions about ureter	1
Neoplasm	4	Fistula	1
Polycystic disease	3	Uncomplicated cases	13
Nephritis	2	No details given	7

Pisani has emphasized this point, stating that "the ureteral insertion at the level of the pelvis with acute angulation of the collar and the sloping cavity in the pelvis predisposes to infection." He reported eight cases in which the kidneys contained calculi. In the series here reported, hydronephrosis was found in three cases and calculi in five.

From these statistics it will be seen that complications are often present, especially renal calculi, and also that due to inadequate drainage, hydronephrosis with a superimposed infection frequently occurs.

Anatomical Findings—Various types of horseshoe kidney occur. The kidneys may be fused either at the upper or lower pole, but the latter type of fusion is more frequently encountered. There is usually a variation in the size of the two lobes, as is demonstrated in the illustrations accompanying this paper (Figs 1-9).

There is also variation in the size and type of the isthmus and in its structure. In some cases the isthmus may consist of a band of fibrous tissue which joins the two kidneys, while in others it consists of renal parenchyma, and it may vary in size from a narrow strip to a band the width of the kidney itself.

The isthmus usually lies anterior to the aorta and vena cava, but Young states that cases have been reported in which it lay between or behind these structures. The position of the kidney is also subject to variation, as it may occupy the pelvis, or it may be in its usual position. Frequently, however, the position of the kidney is lower than the normal.

The course of the ureters also varies from the normal. The two ureters arise from separate pelves, and the pelves may be situated on the external or the anterior surface of the kidney, so that the ureters seem to leave the kidneys in the direction opposite to that observed in a normal pyelogram. Surraco emphasizes the atypical course of the ureter, stating that the lumbar ureter describes a wide curve with an external concavity very near the mid-line, and reaches the pelvis in various ways.

Symptoms—Frequently horseshoe kidney gives rise to no symptoms and is merely an incidental finding at post-mortem examination. Pain, however, may be present, and it may be referred from one kidney region to the other, or occasionally it is quite severe just above or around the umbilicus. Some observers have explained the pain as being due to compression of the vessels or to pressure on the sympathetics, while others state that it is due to disturbance in the flow of urine resulting from the abnormal anatomical arrangement of the pelvis, of the kidney, and of the ureter. The latter explanation seems the more plausible.

The so-called classical symptoms of Rovsing are usually not elicited: pain provoked by changing the position in rising, in lying down or in the course of movements of extension, the pain disappearing on flexion.

When symptoms are present they are frequently referable to coexisting pathological conditions, such as tuberculosis, infection, or calculi. In the cases in which calculi are present, attacks of colic somewhat similar to those occurring in ordinary cases of renal calculi are experienced. In cases complicated by infection, the first symptoms are frequently referred to the bladder, that is, frequency, dysuria, nocturia or hæmaturia, and the true cause of the disturbance is found only by careful study.

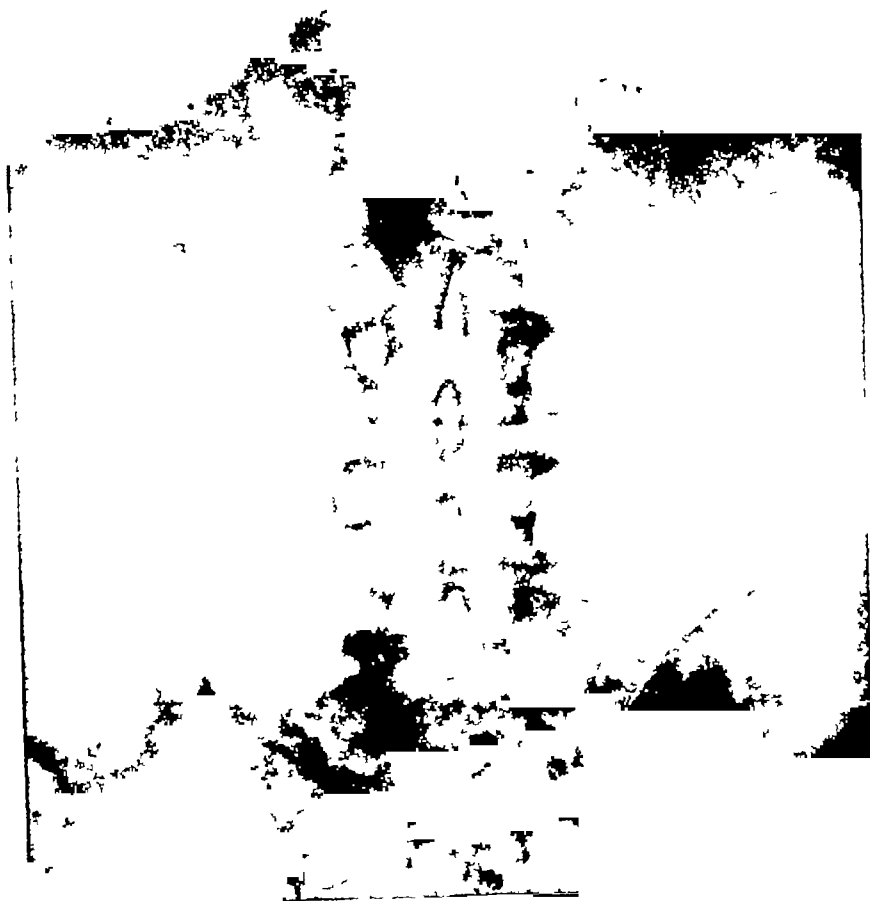
Diagnosis—As stated previously, there are no symptoms which are pathognomonic of horseshoe kidney. Occasionally the mass is palpable on abdominal examination, and in these cases the isthmus may be palpated, while the renal tumor seems to occupy a low position and is fixed. Four of the 108 cases collected by Rathbun were diagnosed by abdominal palpation, masses being palpable on either side of the vertebral column, these being connected across the mid-line by a palpable mass. The findings of palpation may be decep-

FIG 1



Pyelogram of right kidney in Case III showing a large hydronephrosis.

FIG 2



Plain röntgenogram in Case V showing calculi in the right kidney region

FIG. 3

A



B

Right and left pycnograms in Case V. The isthmus is plainly visible in *B*. Both *A* and *B*

FIG. 4



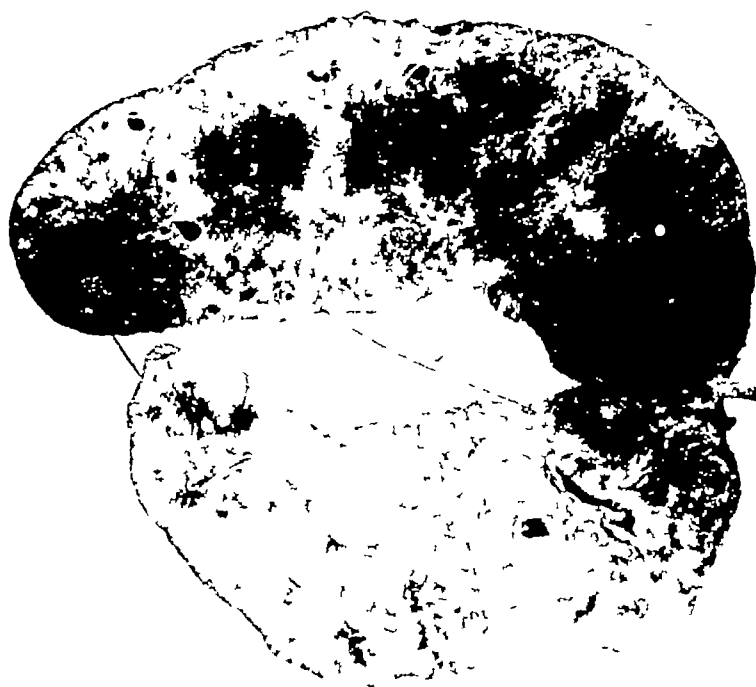
Röntgenograms in Case VI showing a typical outline of a horseshoe kidney

FIG 5



Plain röntgenograms in Case VII in which the kidney outline on each side suggests the presence of a horseshoe kidney

FIG 6



Horseshoe kidney found at autopsy in Case IV

FIG. 7



Right pyelogram in Case XII. Note the position of the ureter and the isthmus.

FIG 8

A



FIG. 9



Röntgenogram in Case XV showing anomalous position of kidneys with fusion at lower poles

tive, however, as the connecting isthmus may not be palpable, or—because of the coexistent pathological conditions, a structural change, such as hydronephrosis, may be present in the fused mass

Rontgenographic plates and pyelograms usually make the diagnosis possible.

In many instances a clear, plain rontgenographic plate shows the outline of the fused kidney with its isthmus. In these cases the upper poles are well defined, while the lower poles are not definitely outlined. The shadow of the kidney is frequently ptosed. In the rontgenogram of a normal kidney, if the line of the inner border of the kidney is projected from its upper pole, it forms an acute angle with the vertebral column. In a horseshoe kidney the relations are reversed, the acute angle appearing if the line of the inner border of the kidney is projected from the lower pole. Boss emphasizes the vertical position of both kidneys, that is, the fact that the inner border of the kidney runs parallel to the spinal column.

The diagnosis is much easier if the horseshoe kidney contains calculi. Zonek and Israel have noted that when multiple calculi are present, the direction of the axis of the kidney can often be determined from the way the stones lie.

When bilateral pyelograms are made the diagnosis should rarely be missed, and even a unilateral pyelogram will disclose certain features, enumerated below, which should lead one to suspect the presence of a horseshoe kidney.

- 1 An unusual position of the kidney pelvis, especially if it is low and near the mid-line, medial to the ureter.
- 2 An irregularly shaped, convex pelvis, with the calices pointing toward the mid-line.
- 3 A bizarre-shaped pelvis, with some calices missing, or with the calices overlapping the pelvis.
- 4 High implantation of the ureter and a sharp ureteropelvic junction.
- 5 Shortening of one or of both ureters, as evidenced by the distance the catheter is passed.

In the presence of such findings a pyelogram of the opposite side should be made at once or a few days later. If a similar picture is secured on the opposite side, the diagnosis is confirmed, and the

rontgenographic plate should be carefully searched for evidence of fusion at the lower pole

Treatment—In cases in which there are no symptoms and the fused kidney is only an incidental finding, no intervention is advisable

In Rathbun's collected series fifty-two heminephrectomies were performed, with eight operative deaths—a mortality of 14 per cent, eighteen pyelotomies, with one death, nine nephrotomies, with two deaths, division of the isthmus in six cases, with one death, one liberation of adhesions about the ureter, one decapsulation, one ureterotomy for calculi, and twenty exploratory operations, with one death

In the series here reported the following operations were performed

Operation	No Cases	Deaths
Pyelotomy	4	0
Heminephrectomy	1	0
Exploratory	1	0

The extraperitoneal route is to be preferred, if it is possible to employ it. The establishing of an accurate preoperative diagnosis minimizes the dangers of such complications as hemorrhage and peritonitis

CASE REPORTS

CASE I—The patient, a man thirty-one years of age, entered the Clinic October 6, 1921, complaining of pain in the left lower quadrant and the left testicle. He had first had pain in the left testicle at the age of ten years, it had lasted for a few years and had then disappeared until 1909, when it reappeared. Eight years before, he had experienced an attack of severe pain in the back in the region of the kidneys, which had lasted for three days. Two years before, he had had another attack and the pain had persisted most of the time since then. For the past month the pain had been severe in the left lower quadrant. There was no history of any urinary disturbance.

The physical examination disclosed nothing of importance except slight tenderness in the left lower quadrant. There were no palpable masses. The urine contained both red and white blood-cells.

The röntgenographic examination disclosed multiple calculi apparently in left kidney.

At operation on January 16, 1922, horseshoe kidney was discovered and because of the presence of several stones in the kidney tissue in addition to a very large stone in the pelvis, heminephrectomy was performed.

In 1927 a cystoscopic examination showed that the right half of the kidney was compensating completely for the left half. A plain plate taken at this

time showed hydronephrosis of the right half of the kidney. An intravenous phenolsulphonephthalein test showed good function, 31 per cent of the dye being returned in four and one half minutes.

CASE II—The patient was a man fifty years of age, who entered the hospital August 12, 1921, complaining of a tumor mass in the abdomen, vague pain after eating and loss of appetite. The tumor had been noted five months before our examination, and the onset of the pain had been one month later. The pain was in the centre of the abdomen and in the right lower quadrant, and it did not radiate. It occurred after eating, was associated with nausea but no vomiting. At first it had been intermittent, but it had become constant, so that the patient ate very little.

Physical examination revealed a tumor mass the size of a hand, firm and movable. It was but slightly tender to pressure, did not move with respiration, and showed no peristaltic motion. The urine contained many mucous threads and a few white blood-cells.

Diagnosis—Possible retroperitoneal sarcoma.

An exploratory operation was performed and the tumor was found to be a horseshoe kidney.

CASE III—The patient was a man fifty years of age, who entered the Clinic October 1, 1923, complaining of hæmaturia and backache. Ten years previously he had noticed blood in the urine, which had later disappeared until one year before, at which time it had again recurred. The hæmaturia was not accompanied by pain. The patient had frequency (every two hours) and nocturia (three).

The physical examination disclosed nothing of importance except tenderness in the right lumbar region. The urine contained both red and white blood-cells.

A pyelogram disclosed slight hydronephrosis of the right side (Fig 1).

At operation on October 10, 1923, a horseshoe kidney was discovered. Right pelviolithotomy was performed. At the last report, in 1925, the patient's condition was good.

CASE IV—The patient was a man thirty four years of age, who entered the Clinic on January 26, 1925, complaining of pain in the right lumbar region radiating down to the right groin and the right testicle. For the past four or five weeks he had been having attacks of very severe pain. Six months before, he had noticed blood in the urine and some frequency. There was no nocturia.

The physical examination disclosed nothing of importance except tenderness in the right lumbar region.

The roentgenographic examination disclosed calculus in the right kidney pelvis.

At operation on January 8, 1926, a typical horseshoe kidney was discovered. Right pelviolithotomy was performed.

When the patient was last seen on October 10, 1928, his condition was excellent.

CASE V—The patient was a man 55 years of age, who entered the Clinic, February 5, 1925, complaining of pain in the lower abdomen. The symptoms had been present for twenty five years. At times he had severe pain in the pit of the stomach, and he had many attacks of colic. He had passed one stone a year previously. The pain was always on the right side, there was never

any hæmaturia or chills and fever. The patient had had frequency at times, and nocturia (one).

The physical examination disclosed nothing of importance except tenderness just above the umbilicus in the region where the pain was usually felt. The urine contained a few pus cells.

A plain röntgenogram revealed three calculi in the right kidney region, and right and left pyelograms revealed that the stones were in the right side of a horseshoe kidney (Figs 2 and 3).

At operation on February 11, 1925, a typical horseshoe kidney was disclosed. Right pelvolithotomy was performed.

Two years after operation the patient was free from symptoms.

CASE VI—The patient was a woman twenty-eight years of age, who entered the Clinic October 8, 1925, complaining of pain situated high in the abdomen and radiating around both sides to the back. Fifteen months before, she had experienced the first attack of pain, and since then she had had ten attacks. She had occasional attacks of frequency and burning. Nocturia (two).

Röntgenographic examination disclosed a horseshoe kidney (Fig 4).

CASE VII—The patient was a man forty six years of age, who entered the Clinic May 5, 1926, complaining of heart attacks. Three months before, he had awakened with a feeling of dizziness and nausea. He had severe cramps in the abdomen and felt cold and clammy. The physician gave him stimulants and he felt better the next day. He still had some pain around the heart, and at times he had severe pain in the epigastrium. During an attack he had fear of impending death.

The physical examination showed the heart to be enlarged, with a systolic murmur over the precordium, most marked at the base—these symptoms suggesting the presence of coronary thrombosis. The urine contained a few pus cells.

The röntgenographic examination disclosed a horseshoe kidney (Fig 5).

CASE VIII—The patient was a man forty-one years of age, who entered the Clinic August 10, 1928, complaining of pain in the back. For the past year the patient had had attacks of pain in the left lumbar region, with tenderness of the muscles on both sides, three of the attacks being severe. The last attack, which had occurred two days before, had come on suddenly with severe sharp pain in the mid line of the back, radiating to both groins. The physician had found blood and pus in the urine.

The urine contained blood and pus.

The plain röntgenogram showed two dense shadows in the left upper quadrant which were believed to be calculi in the left kidney. A left pyelogram showed hydronephrosis and a rotated kidney which was believed to be the left half of a horseshoe kidney.

Left pelvolithotomy was performed and one month after operation the patient's condition was excellent.

CASE IX—The patient was a man seventy years of age, who entered the Clinic on September 8, 1928. He was semi-comatose at the time he entered the hospital. In 1914 he had had an attack of bladder trouble associated with frequency and nocturia. He was seen by a doctor at that time and prostatectomy was recommended. Since then he had had frequency and nocturia, occasional hæmaturia, and some difficulty in starting the stream. Three weeks before he

had begun to have nausea and vomiting, and the day before he entered the hospital he was unable to void

A physical examination disclosed a large hypertrophied prostate

The patient died shortly after entering the hospital. A horseshoe kidney was found at autopsy (Fig 6)

CASE X—The patient was a man fifty nine years of age, who entered the Clinic on September 19, 1922, for excision of cyst of the breast. A horseshoe kidney was found incidentally in the course of the roentgenographic examination. There were no symptoms referable to the genito urinary tract

CASE XI—The patient was a man fifty years of age, who entered the Clinic in January 22, 1924, complaining of difficulty in urination. A previous history of gonorrhœa was elicited.

The patient occasionally had difficulty in starting the stream, some frequency, and nocturia (two to four)

The physical examination disclosed nothing of importance except stricture of the urethra and moderate hypertrophy of prostate

A pyelogram gave a picture suggesting the presence of a horseshoe kidney. In this case there were no symptoms referable to the kidney

CASE XII—The patient was a man thirty years of age, who entered the Clinic on May 13, 1924, complaining of blood in the urine and pain in the testicle. He had first noticed blood in the urine six months previously, and it had been accompanied by pain in the back. The pain had disappeared spontaneously. On the day before our examination he had again passed blood, but there was no pain or frequency

The physical examination disclosed nothing of importance except for a mild enlargement of the prostate. The urine contained blood and a few pus cells

A pyelogram disclosed hydronephrosis on the right side of a horseshoe kidney (Fig 7)

CASE XIII—The patient was a man sixty five years of age, who entered the Clinic on October 25, 1927, complaining of the passage of stones in the urine. This had occurred at various times during the preceding three or four years, and in the preceding week he had passed three calculi. He had no pain except when passing calculi, and had not had any attacks of hepatic colic. There was marked frequency and some dysuria

The physical examination disclosed nothing of importance. The urine contained blood and pus

On cystoscopic examination five large calculi were found in the bladder

The roentgenographic examination disclosed a horseshoe kidney. No calculi were found in the kidney

Cystolithotomy was performed and the patient was in excellent health one year later

CASE XIV—The patient, a man, presented himself at the Clinic on June 13, 1928, complaining of pain in the lower right abdomen which radiated to the right testicle. About one week before our examination he had had indefinite pain in the right lower abdomen, which had become very severe and had required large doses of morphine for relief. The pain radiated to the right testicle. The patient was not certain whether he had passed any blood in the urine. At

the time of our examination he had moderate pain in the right lower flank and abdomen

The physical examination disclosed nothing of importance except symptoms of right renal colic and moderate tenderness in the right lower abdomen, extending over into the loin. The urine was acid, with a moderate amount of albumin and sugar. Microscopic examination showed it to contain numerous red blood-cells and to be loaded with pus. Catheterized specimens from both kidneys showed pus cells, no organisms.

A pyelogram disclosed a horseshoe kidney (Fig 8)

No surgical intervention was attempted and after four days in the hospital the patient improved. He had had no further renal colic.

CASE XV—The patient, a man fifty five years of age, presented himself at the Clinic on July 11, 1927, complaining of loss of strength, and especially of weakness of his legs, frequency of urination, and severe constipation. About twelve years before, the patient had had trouble with constipation and a year or so later he had been troubled with frequency and difficulty in holding his urine. This cleared up, but had recurred about six years before our examination and was associated with enuresis. About a year before, he had been in an accident and since then had been more nervous and had gradually lost in weight.

Physical examination disclosed nothing of importance. The urine contained numerous pus cells.

On cystoscopic examination trigonitis and contracture of the prostatic urethra were found.

A roentgenogram showed the kidneys to be in an anomalous position, with fusion at the lower pole betraying the presence of a horseshoe kidney (Fig 9)

CASE XVI—The patient was a woman fifty two years of age, who came to the Clinic on September 25, 1926, complaining of pain on the inner side of the left foot, pain in the back, and fainting spells.

On physical examination the condition was thought to be entirely an orthopaedic one. The urine contained some pus.

The presence of a horseshoe kidney was a chance finding in a roentgenogram of the lumbosacral region.

CASE XVII—The patient was a man sixty five years of age, who presented himself at the Clinic on August 18, 1925, complaining of pain in the left side. He had noticed a slight pain in the left flank for six or seven years, which was made worse by lifting heavy objects. He had slight difficulty in passing urine.

The physical examination disclosed nothing of importance. The urine contained numerous pus cells.

The roentgenographic examination disclosed some hypertrophic arthritis in the lumbar spine which was thought to be the cause of the trouble. It also revealed a horseshoe kidney.

CASE XVIII—The patient was a woman sixty four years of age, who presented herself at the Clinic on July 15, 1924, complaining of rheumatism which she had had for fifteen years.

The urine contained some pus cells, a few hyaline casts, a moderate amount of mucus and a moderate amount of epithelium.

The condition was diagnosed as chronic rheumatism. The presence of a horseshoe kidney was a chance finding in the roentgenographic examination.

THE LIGATION OF THE JUGULAR VEIN AND THE REMOVAL OF OBSTRUCTIVE THROMBI IN OTOGENIC SINUS THROMBOSIS

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GREAT differences of opinion as to the indications for ligating the jugular vein have existed for a long while. A survey of the literature exhibits two chief opposing groups: surgeons who practice ligation in every or almost every case of sinus thrombosis, even before operating on the mastoid, and other surgeons who perform ligation only provided certain indications present themselves, which may differ rather considerably from one another. The essential point of the whole problem of ligation is: *Shall we fundamentally ligate the jugular vein in otogenic sinus thrombosis, or shall we do so only under certain considerations?* Let us begin by examining this problem more fully.

Theoretical discussions concerning the advantages or disadvantages of the method practiced or recommended at the time are futile, since success alone finally determines the value of any therapeutic measure. In practice we can seldom compare a series of identical cases treated according to one or the other method of jugular ligation in order to judge its advantages or disadvantages. Therefore, we must resort to statistical data which may possibly help us evaluate the method under discussion by comparing (1) the ratio of recovery among patients treated with or without ligation, (2) total recoveries of patients treated fundamentally with or without ligation.

The accompanying table summarizes the ratios of recovery of identical series examined.

Name	Total no of patients	Jugular ligation	Per cent. cures	No jugular ligation	Per cent. cures
Brieger	26	10	50	16	50
Kuemmell	12	6 (4)	50	6	83
Lutz (only chronic suppurations)	20	11	54	9	66.5
Giesswein	200	110	50	90	46
Ludwig Haymann	59	25	56	34	89

This survey of over 300 patients shows an average of 52 per cent of recoveries for ligated, and of 57 per cent for non-ligated cases. It becomes perfectly obvious, therefore, that *recovery from sinus thrombosis frequently occurs without ligation of the jugular vein, notwithstanding the statement of its accidental and rare occurrence made by those who fundamentally oppose this method.* The low percentage of cures for ligated in comparison to non-ligated patients is not due to the fact that ligation was done too late, otherwise the ratio of mortality for the non-ligated would have to be much higher. Nor is it because these patients presented associated endocranial complications, for if such complicated cases be excluded the percentage remains the same for those with or without jugular ligation. It is rather because the patients treated with ligation presented from the beginning severe and often even fatal diseases.

It is particularly instructive to *compare for large identical series, total ratios of recoveries from operations of sinus thrombosis combined either with fundamental ligation or with definitely indicated ligation.* Alexander reported 85 per cent of recoveries among approximately ninety-six operations for sinus thrombosis, chiefly combined with fundamental jugular ligation. In our series of over 100 patients definitely indicated ligation resulted in 83-90 per cent of recoveries. *Fundamental exclusion of the jugular vein shows, therefore, no results superior to those of definitely indicated ligation.*

Let me briefly explain whether there are definite types of sinus thrombosis where ligation of the jugular vein is more or less indicated. The assumption has been made by some that ligation of the jugular vein might be practically eliminated in sinus thrombosis following acute otitis media, while it would practically have to be done in sinus thrombosis following chronic otitis media. It must be admitted that sinus thrombosis following acute or chronic otitis media exhibits marked differences in the sense that the first type progresses far more benignly, while the latter type often proves serious. But the previously cited indication, that ligation should depend upon whether the causative otitis media be acute or chronic, is contradicted by the facts that *in our series 81 per cent recovered from sinus thrombosis without ligation after chronic otitis media, while in 45 per cent of sinus thrombosis following acute otitis media the patients died in spite of ligation.*

We understand that large series may present fairly identical ratios of recovery from sinus thrombosis combined with or without jugular ligation. What reasons may be advanced in favor of fundamentally ligating the jugular vein? And what are the objections to this method?

The usual argument *in favor* of jugular ligation is that exclusion of this path chiefly prevents metastatic development. Since the venous connections surrounding the bulb are so numerous, and since clinically we may frequently observe thrombosis advancing toward the *confluens sinuum* ("Torcular"), we need hardly emphasize the invalidity of the above argument. Our large experience has also taught us how erroneous it is to assume that the danger of toxic infection is increased by manipulating the sinus when the jugular vein has not been ligated. *From the point of view of metastatic development it is thus useless to block the jugular tract indiscriminately.*

What objection should then be raised against the fundamental ligation of the jugular vein?

If we disregard injuries to the vagus and the accessory nerves, or the development of air embolism—probably caused rather by faulty technic than by the method itself—we have chiefly before us phenomena of brain stasis and of the progressive spread of thrombosis to the cerebral sinus in consequence of ligation. There is some actual danger, which may be considered rather unimportant, that ligation may cause disturbances in the intracranial area where the jugular vein arises. The danger is, however, much greater that under the changed conditions of blood circulation due to ligation, particles of thrombi may be loosened and carried off, so that a blood column situated above the point of ligation may become rapidly thrombotic and suppurative. We have many proofs of this which cannot be fully discussed at this moment. Finally fundamental ligation, as practiced by many before exploration of the sinus, always rests upon the presumption that sinus thrombosis may be purely clinically diagnosed *before* the sinus has been opened. This is often claimed, yet every experienced otologist knows that *it does not come true*.

We conclude that ratios of total recoveries from otogenic sinus thrombosis combined with fundamental ligation of the jugular vein are no better than those of definitely indicated ligation. Exclusion

of the vein does not absolutely prevent infectious substances from invading blood circulation. Moreover, ligation is attended by certain dangers. *Therefore the proper aspect seems to us to practice ligation not systematically, but only when definitely indicated.*

Under what circumstances should the jugular vein be ligated in otogenic sinus thrombosis associated with general infection?

Since opinions widely differ on more or less significant details with respect to definitely indicated ligation, and since a comparison between these different opinions would be useless without a corresponding critical evaluation, which would take too much time, I will confine myself to stating *our* reasons for practicing ligation. They fairly agree on the whole with those given by Heine and Brieger.

Personally I consider ligation of the internal jugular vein indicated in

- 1 Thrombophlebitis of the jugular vein

- 2 Primary or secondary obstructive thrombosis of the bulb inducing severe general symptoms (metastasis, etc.)

If severe general symptoms be wanting, then only in severe local symptoms: gangrenous wall, ichorous suppuration, peribulbar abscess, in order to prevent the spreading of thrombotic particles during bulbar operation.

- 3 Atypical appearance of the central terminal thrombus or discoloration of the sinus wall. It may be possible to reach the central terminal thrombus of the sinus sigmoideus yet impossible to remove it extensively because of bulbar hemorrhage.

- 4 Terminal thrombi, or such severe symptoms as to prevent local elimination of the area involved (e.g., terminal bulbar thrombosis), so that symptoms of severe general infection persist.

With relation to time versus operation the jugular vein should be ligated,

- I *Before* operation on the sinus only if.

- 1 Thrombophlebitis of the jugular vein itself presents definite symptoms.

- 2 Bulbar thrombosis associated with severe general phenomena has been exceptionally diagnosed from the beginning.

In these cases sinus or rather bulbar operation should be *immediately* followed by ligation and opening of the jugular vein

II *Immediately after* sinus operation

- 1 If symptoms indicate involvement of the jugular vein itself
- 2 If secondary or primary obstructive thrombosis of the bulb is diagnosed and causes severe general symptoms

Otherwise only in severe local symptoms of the bulb gangrenous wall, ichorous suppuration, etc., where further handling of the bulb may possibly cause the invasion of the blood stream by thrombotic particles

- 3 If in atypical appearance of the thrombus and discoloration of the wall the central terminal thrombus may be reached in the sigmoid sinus but cannot be extensively removed because of bulbar hemorrhage

If these cases *require operation of the bulb* it should be *preceded* by jugular ligation

III In the further progress of the disease, provided

- 1 The process involves the jugular vein
- 2 Thrombosis spreads to the bulb, and
 - (a) Severe general symptoms present themselves that, after excluding another source, *e g*, the peripheral terminal thrombus of the transversus, must be attributed to the bulb
 - (b) Otherwise only in severe local symptoms already listed under II 2
- 3 Terminal thrombus or corresponding symptoms are present and the septic focus in the sinus can neither be reached nor be locally controlled, so that symptoms of general infection persist.

It is difficult to formulate such apparently chance indications. Therefore, the directions given should be considered aspects of, rather than fixed rules for performing jugular ligation. In my opinion it is impracticable to give indications covering every possible combination. The clinical symptomatology, the patient's constitution, the presence, number and kind of metastasis, the type of infection and causative otitis media—all this combined will determine whether we

do a rapid and early ligation or maintain an attitude of watchful waiting

Let me emphatically state that *jugular ligation should invariably be followed by opening of the venous stump* Only in this way can we attain the objective of ligation, that is, provide the effective drainage and extensive exclusion of the diseased vascular section above the point of ligation Jansen and Brieger have already insistently recommended using the peripheral venous stump as drainage tube for the area beyond the diseased portion Alexander instituted this drainage method by systematically provoking a dermal fistula adjoining the jugular vein—approximating the skin in the upper portion of the cervical wound to the opened peripheral jugular section Occasionally the peripheral jugular stump should be isolated and split down to the base of the skull If the jugular vein still carries abundant blood, opening the lumen immediately after ligation is useless for it cannot be kept open during hemorrhage But it should be opened as soon as practicable

Total thrombectomy is another and much debated problem in the surgical treatment of otogenic sinus thrombosis Should obstructive thrombus always be removed before bilateral hemorrhage sets in? Or should only so much be removed as its condition requires? It is impossible macroscopically to establish the benign or malignant character of the terminal thrombi In accordance with our experimental data they usually prove benign Yet, should the affection decidedly tend to spread along the wall then secondary thrombi would probably be infectious It is, therefore, our practice to remove suspicious looking thrombi as completely as possible, but to leave benign looking terminal thrombi unless further clinical symptoms indicate them as a source of later infection

	Percentage total cases of sinus thrombosis	Percentage less deaths from menin- gitis and brain abscess
I. Definitely diagnosed thrombosis	73	84
II Including patients where severe changes of the external sinus wall indicated definite general infection (bacteremia metastasis)	77	86
III Including patients showing in addition clinical symptoms indi- cating general infection	83	90

In our series there were 47 per cent. of recoveries after complete removal of the thrombi while the remaining cases showed 53 per cent of recoveries. Fiand, who recently warmly recommends total thrombectomy, reports 75 per cent of recoveries in comparison to the 83 per cent with our method. *Tabulated percentages of recovery in our series of sinus thrombosis are to be found on page 212*

PATHS OF INFECTION IN OTOGENIC MENINGITIS

It is a familiar fact that otogenic meningitis may develop from some other endocranial complications, either labyrinthine suppuration or directly from the mastoid process. I shall not discuss the first two possibilities nor the continuous involvement of the dura from the mastoid. But I shall turn to those cases where no path of infection is macroscopically demonstrable at operation. I have clinically observed such patients and operated on them. Post-operatively I have made histological studies and will now demonstrate with some histological slides how the disease spreads to the meninges.

The cases investigated were clinically very similar, progressing about as follows. Acute otitis media. Early paracentesis. Rapidly subsiding severe initial inflammatory symptoms. Occasional severe headache, sometimes nervous in type, subsiding soon. After two or three weeks no more or only very little ear suppurations, the tympanic membrane gradually paling. Mastoid process negative. Increased hearing. Good general health. Sudden headache associated with meningeal symptoms. Excitable labyrinth. Immediate and extensive mastoidectomy resulted in macroscopically negative mastoid findings. Spinal fluid usually contained streptococcus mucosus. Increasing meningitis. Exitus after several days.

Demonstration of specimens. The histological section clearly shows the path of infection. The disease spread from the middle ear below the labyrinth to the pyramidal tip and from there to the meninges. It travelled originally along a column of pneumatic cells whence it spread to adjacent medullary spaces. Endocranial involvement occurred at two spots where (1) the bone softened on the posterior pyramidal aspect medially from the internal acoustic foramen, (2) involvement of the jugular foramen near the petrosal fossa caused the infection to spread along the nerves in this area. *I would like to stress that, in contrast to the spread of sup-*

purative otitis media along the upper pyramidal margin, its spread below the labyrinth to the pyramidal tip and the jugular foramen has apparently thus far not often been demonstrated histologically

It cannot be absolutely diagnosed at what stage of acute otitis media this spread of infection occurs. Protracted cases are certainly subject to it, but the chief danger may possibly already exist from the onset of the acute disease.

There are no definite indications before meningeal symptoms appear. Yet unilateral headache and aggravated neuralgia should be suggestive, particularly if the roentgenogram simultaneously reveals extensive pneumatization toward the pyramidal tip

If the process has already settled in the pyramidal tip there is small hope of successful operative interference, even though the healthy labyrinth were removed by total mastoidectomy. Yet this operation will hardly be done so long as the diagnosis remains uncertain. It would also be *wrong* to conclude that it should be done early in every case of acute otitis media in order to forestall the possibility of meningeal involvement. We do not recommend early operation in acute otitis media and our large series shows a better average percentage of recoveries—*about 96 per cent of continuous operations in unselected cases*—than that of surgeons recommending early mastoidectomy in acute otitis media.

CONGENITAL ATRESIA OF BILE DUCTS

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ICTERUS occurring in the new-born baby necessitates the differentiation between (1) icterus neonatorum which is, as is well recognized, not a serious condition, (2) icterus occurring in association with congenital obliteration of the bile ducts, (3) familial icterus of the new born, (4) congenital hemolytic icterus, finally that type of icterus (5) which is in association with sepsis. In an icterus that persists with the presence of acholic stools with a choluria, and with an immediate positive van den Bergh blood test, the presence of biliary duct atresia must be seriously considered. The other types of jaundice may be differentiated as follows:

Icterus neonatorum is essentially evanescent, the mortality of which is practically nil. On the other hand, the familial icterus of the new-born, cases of which have been placed in the literature by Abt, is an exceedingly fatal disease and there is a tendency toward repetition in the family. Congenital hemolytic icterus is characterized by the extreme fragility of the red blood corpuscles. There is present an anemia with a high color index and a mononuclear leucocytosis. The spleen is almost invariably enlarged. (A splenectomy in this condition has frequently relieved the symptoms.) Bile pigment is always present in stools and there is no cholemia demonstrable. With the presence of infective icterus, there is marked prostration, general septicemia is often present, appetite is poor, there is vomiting, and the result is at an early time fatal, multiple abscesses often being found in the liver.

Congenital obliteration of the bile ducts is frequently reported in literature. An admirable presentation of this subject with collated cases was made by James B. Holmes, in the *American Journal of Diseases of Children*, June, 1916. His conclusions at that time can be quite readily subscribed to, particularly the emphasis that he lays on this condition being a developmental anomaly rather than the result of an inflammatory antenatal condition in the liver. The elimination of syphilis as a causal factor of the obstruction should

be made where congenital atresia is suspected Both the Wassermann and the Kahn tests were negative in the case I am to report With a diagnosis of congenital biliary atresia, it is perfectly evident that what chance the baby has rests upon a laparotomy with an ocular and digital investigation of the biliary tracts, in so far as is possible

In the dietetic management of these cases it is rational to reduce the fat intake to the minimum Although it is recognized that the pancreas secretes steapsin which is a fat-splitting enzyme, it should be observed that its activity is increased greatly by the presence of bile salts in the duodenum.

REPORT OF CASE

Family History—Mother and father in good health Four other children born 1912, 1915, 1918 and 1923, all breast fed early months No miscarriages No jaundice Parents deny any history of previous jaundice in family

Previous Personal History—E R., a white male baby, was born January 1, 1927 Non instrumental delivery Weight, $7\frac{1}{2}$ pounds When three days old was decidedly jaundiced, which condition has continued in varying degrees Wholly breast fed until January 26th, at this time the doctor in attendance thought that the gain in weight was not satisfactory, and so the child was given two tablespoonfuls of Dryco, to four ounces of water complementary, and the mother was advised to feed the baby at the breast for ten minutes every three hours both night and day Mother reported that stools were always clay-colored and pasty, and that there were as many as five each day There was much crying and restlessness, sleep never good

Examination on February 26, 1927 Fairly well nourished Entire skin has a decided icteroid tint with yellow colored conjunctivæ. There is an umbilical hernia and a swelling in the right inguinal region which transmits light. Heart and lungs negative Abdomen prominent and distended. Liver not palpable, neither is the spleen Diaper stained yellow from urine Enlarged lymphatic glands in the right axilla and in both inguinal regions Over the upper chest is a papulomacular eruption, scattered through which are excoriations

Impression—Obstructive jaundice, umbilical hernia, hydrocele right Decid edly over fed Eruption "heat rash."

Suggestions—Feed at the breast every three hours during the day, four hours at night. Reduce the quantity of the complementary feeding

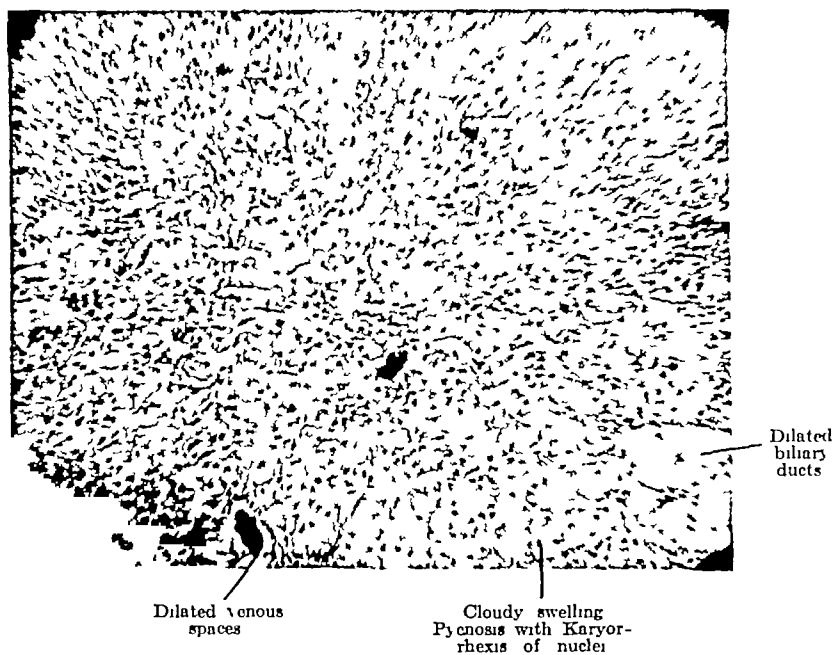
March 2d Baby slept last two nights for the first time

March 14th Weight 10 pounds, 12 ounces

March 16th Wassermann negative Kahn test also negative

Red cell count	3,860,000
White cell count	9,800
Hemoglobin estimation	70% (Dare)
Coagulation time	5 minutes
Blood platelets	300,000

Fig 1



Photomicrograph of liver

Differential white cell count

Polymorphonuclears	30%
Lymphocytes	60%
Mononuclears	9%
Eosinophiles	1%

March 20th Stool examination Bile negative At this time is fed skimmed Lactic Acid Milk with Karo

August 12th Entered Children's hospital for purpose of study Blood examination as follows

White blood cells	13,600
Lymphocytes	80%
Polymorphonuclears	19%
Eosinophiles	1%

Jaundice intense, it is the impression of various observers that it varies in intensity from time to time Van den Bergh blood test showed immediate direct positive reaction. Stools, frequently examined, negative for bile. Urine yellow, containing bile Stools offensive Abdomen increasing in size Liver now easily palpable Baby scratches face and body

August 17th Baby discharged from hospital Parents consistently refuse any operative procedure, taken to a hospital in a neighboring city where mother states that it was the desire of attending surgeon to perform operation, which was refused.

December 20th Baby readmitted to Children's hospital At this time, the parents consent to an abdominal section The object of the surgery is to discover whether or not there is any remediable obstruction to the common bile duct, with the possibility of performing a cholecystogastrostomy At this time the coagulation time was found to be 9 minutes 30 seconds Hemoglobin 47 per cent, there being 7.95 gms per 100 cc of blood Red blood cells 3,670,000, white blood cells 14,000 Child urinates frequently, passing large quantities of orange yellow urine Abdomen now considerably distended. Liver felt midway to umbilicus

December 24th Under ether anaesthesia, Dr Charles Stanley White, opened the abdomen, and it was found that there was a large dark green liver with a somewhat distended gall bladder No common duct could be located. The fluid within the gall bladder was removed, which did not have the macroscopic appearance of bile There was present mucus, with some granular debris It was thought with the abdomen open that although no bile appeared in the gall bladder, what little chance there was should be given the baby by forming an anastomosis between the gall bladder and the stomach. Accordingly this was done A small section of the liver was removed between ligatures for a microscopic examination Dr J W Lindsay reported on this later, that in the lobules of the liver the cells showed cloudy swelling and fatty degeneration. "There was considerable deposit of bile pigment and apparent dilatation of the bile ducts Slight leucocytic infiltration in scattered areas No evidence of malignant change"

There was a remarkably good operative recovery However, no difference in the intensity of the jaundice resulted. Stool examination on the 28th showed

no evidence of bile. The urine was found to contain 4 gms albumen per 100 cc, with bile present. No vomiting followed operation, and a return was made to skimmed Lactic Acid Milk.

January 8, 1928 Discharged from hospital Weight on admission was 15 pounds 8 ounces, when discharged, 15 pounds 1 ounce

January 11th General appearance good, active, still has an abdominal bandage Wound healed perfectly The parent is given a supply of a preparation of ox bile, to be administered over a period of two weeks The stools meanwhile took on a different appearance The normal color gave some ease to mother's feelings but accomplished nothing more

February 8th Reported to have had 14 or 15 small stools containing mucus during the last 24 hours Cries good deal, had a very restless night Prescription given containing paregoric, bismuth subcarbonate, acacia and elixir digestive compound. At the same time, the baby's sister, three years old, for lack of appetite with adenopathy was given syrup of iodide of iron, 7 drops in water to be taken three times a day through a tube The bismuth paregoric mixture was prescribed, one teaspoonful every three or four hours

February 9th There was but little sleep during the preceding night Stools even more frequent, deep green in color; evidently considerable pain Inspection of two bottles containing medicine revealed that the druggist had placed the label for the syrup of iodide of iron on the bismuth bottle and the label for the bismuth was on the bottle containing the syrup of iodide of iron The result was that the baby received eight teaspoonfuls of the syrup of iodide of iron undiluted His tongue is dark in color, considerably swollen, as is the roof of his mouth He refuses to take the nipple, neither will he swallow any solids or cereal (Next day he took some iced buttermilk, jello and custards in small quantities)

February 11th Examination of the chest reveals posteriorly over upper lobe of left lung definite evidence of changed breath sounds, increased voice sounds present.

February 20th A paracentesis of left ear drum is done, pus obtained, face at this time decidedly swollen, especially the eyelids which are very puffy

For the last few weeks there has been an increasing clubbing of both the fingers and toes (hypertrophic pulmonary osteoarthropathy) General appearance in last month quite striking, abdomen enormous, with a well-defined compensatory kyphotic bending of the lumbar spine Mother reported on the 14th that, "The baby had gained one pound in the last three days"

February 21st A unilateral oedema of lungs was evident, the left lung showing numerous moist rales The right chest was remarkably clear

General appearance Color is even darker than it has been It is now a dark green Mother states that in the last 24 hours the urine "stained," even more than previously Stools resumed a clay colored appearance For a few days they were dark During the ingestion of the syrup of iodide of iron they were green

Along the whole right lateral half of abdomen, beginning in the right hypochondrium extending along toward the flanks, are enlarged veins running longitudinally No enlargement of veins noted on the left side of abdomen nor in the region of umbilicus The abdomen is decidedly tympanitic in its upper portion Lower down in flank, with the baby in dorsal decubitus, there is dulness

February 22 Exitus occurs Necropsy is refused, however, the following measurements were obtained post mortem

Girth of the chest at level of nipple	39.5 cm
Girth of abdomen, level of umbilicus	57.5 cm
Margin of liver below costal margin	7.0 cm
Total length of body	71
Circumference of head	42.3 cm

Weight of baby was said to have been 18 pounds on the 21st of February
Weight, post mortem, 18 pounds 12 ounces

SUMMARY

(1) After the diagnosis of congenital atresia of the bile ducts was made, an operation was indicated. Holmes in his article shows through diagrams of the various forms of obstruction that approximately 16 per cent of the cases reported in literature might have been improved by operation. With an obliterated cystic duct, as present in this case, the chances for success are practically nil.

(2) The good operative recovery with freedom from vomiting and hemorrhage in a baby with extreme jaundice is worthy of comment.

(3) The microscopical examination of a section of liver tissue that was removed from this baby by Dr J W Lindsay, revealed some cloudy swelling and fatty degeneration of the liver cells. This was not a frequent pathological finding in congenital atresia. The apparent dilatation of the bile ducts was noteworthy, especially in view of Counsellor's article in which he gives his results after actual measurement of injected bile ducts in livers of adults. Normal livers showed diameter of common duct 5 mm, ducts of 5th order 0.5 with obstruction such as cholelithiasis to carcinoma of pancreas, common duct 10-30 mm, 5th order 1 to 2. No measurements have been made, as far as I know, in the obstruction of congenital atresia.

(4) This baby lived for 13 months 22 days. Of the cases reported in literature, the extent of life of this baby was longer than the average, as death most frequently occurs during the early weeks. In those with greater longevity than the case I have reported, it might be suspected that the obstruction was not absolute.

(5) Skimmed Lactic Acid Milk seemed to be very well tolerated by this baby. The rationality of this mode of feeding is referred to above.

(6) Death occurred as an immediate result of an infective process of the lung (pneumonia upper left lobe), with a unilateral pulmonary œdema. Hæmorrhages, either subcuticular or from mucous-membranes, were never a prominent factor, despite the reduced liver function.

(7) The ingestion of eight teaspoonfuls of syrup of iodide of iron, undiluted within thirty-six hours by a one-year old baby should be mentioned in emphasizing the need for more careful rechecking before Rx are sent out by the apothecary.

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Dermatology

DIFFERENTIAL DIAGNOSIS OF SOME SYPHILITIC AND NON-SYPHILITIC ERUPTIONS *

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FOR the diagnosis of syphilitic eruptions of the skin, a certain clinical knowledge of non-syphilitic diseases is necessary. The Wassermann test cannot be relied upon as final in spite of its great value. Its failure to be positive in many cases of late syphilis is well known. More mistakes in diagnosis will be made by relying entirely on the Wassermann test than upon clinical experience. Both sources of information should be utilized.

In the diagnosis of diseases affecting the skin I am firmly convinced of the value of objective study before the history is taken. Dermatological affections differ from those of the internal organs in that their gross pathologic changes are exposed to view. Not only can they be studied by the eye but the sense of touch as well. Their situation is also peculiarly favorable for histologic study by means of the biopsy. After the eruption has been objectively seen, the history should be taken and any necessary laboratory investigations made. A full history is always of value, even though the diagnosis be made by a momentary glance.

The objective method of first studying an eruption is of great value in sharpening diagnostic acumen. It is also of value in infants, in persons speaking a foreign tongue, and in malingerers, and at times avoids the necessity of asking embarrassing and compromising questions. Such a method also prevents undue importance being attached to the patient's social status.

In the time at my disposal, my remarks will be confined to the differential diagnosis of some of the early and late syphilides and

* Read before the New York Academy of Medicine, Practical Lecture Series, March 16, 1928, and received for publication in the INTERNATIONAL CLINICS on November 8, 1928.

no reference will be made to either the primary lesion or to congenital syphilis

Before discussing individual eruptions which must be differentiated from syphilis the general diagnostic features of the latter disease should be recalled. The early or first year syphilides tend to be generalized and symmetrical, to be polymorphous and, as a rule, to show no special configuration. They disappear spontaneously and usually without trace. The color is generally described as "lean ham" and there is a notable absence of itching. The early syphilides are known as macular, papular or pustular, the late, as nodular, gummatous and squamous.

The macular syphilide, which is the earliest rash, may simulate a drug eruption, especially due to one of the coal-tar products. History of taking a drug, the rapid disappearance of the lesions after its discontinuance and absence of concomitant symptoms of syphilis will usually settle the diagnosis. (Fig 1)

Pityriasis rosea is not infrequently confused with the common type of macular syphilide (roseola). The possibility of such a mistake in diagnosis constitutes, to my mind, the chief importance of *pityriasis rosea*, which is otherwise a harmless and rather trifling affection. When it presents circinate lesions, well marked scaling, and evidence of itching, there is no difficulty in diagnosis. Some cases, however, of *pityriasis rosea* do not itch at all, are not perceptibly scaly or very slightly so and consist entirely of macules of varying size, which may strikingly simulate a macular syphilide. In this case the Wassermann test is of the greatest value. A positive test does not entirely exclude *pityriasis rosea* (occurring in a syphilitic) but an absolutely negative test practically settles the diagnosis in favor of *pityriasis rosea*. (Fig 2)

The type of macular syphilide (vitiligid), improperly called pigmentary syphilide, is so distinctive that it could hardly fail to be recognized. It occurs almost entirely in women and chiefly on the neck or neighboring parts of the chest or upper back. It presents a reticulated appearance, as if the patient had been exposed to the sun while wearing a veil about the neck. It is persistent, resists anti-syphilitic treatment but disappears spontaneously in a year or two. The rare type of annular macular syphilide is to be distinguished from the annular papular syphilide so characteristic of negroes. This

type is seen chiefly in women, is persistent, often recurs and may appear many years after infection. It is decidedly inconspicuous and frequently escapes notice. Its appearance suggests toxic erythema except that it has no subjective symptoms and runs an indefinite course.

The military papular syphilide consists of small pin head lesions appearing in groups, especially on the trunk and extensor surface of the extremities. It is apt to be rather profuse, is characteristic in appearance and occurs rather infrequently. Its differentiation from lichen scrofulosorum is difficult at times from the appearance of the eruption. The latter is rare in this country and as a rule is seen in young persons suffering from some form of tuberculosis. Lichen planus may at times resemble the military syphilide. A classic case is easily recognized by the flat, angular, shiny papules coalescing to form patches of a violaceous hue, and the frequent involvement of the mucous membrane of the mouth and genitals. Pityriasis rubra pilaris may resemble the military syphilide when the eruption is in the early stage and consists solely of papules. In the former affection the papules are more acuminate and scaly and there is usually some coalescence of the lesions to form scaly patches and in addition there are characteristic plugs on the back of the fingers and diffuse keratosis of the palms.

The most characteristic and best known of the papular syphilides is the lenticular variety, commonly affecting the face as well as the trunk and extremities (Fig 3). In addition to the usual features of the early syphilides such as "lean ham" color, absence of itching, tendency to scaling, etc., it presents a well-marked infiltration which is best recognized by palpation. The term "fleshy lumps," used by Tilbury Fox, well describes the infiltration of these lesions which is most evident through the sense of touch. In this connection it should be said that palpation of syphilitic lesions is often a valuable aid to inspection. Furthermore, it should be realized that this can be done without any risk of infection as long as the cutaneous surface is dry and unbroken. Spirochaetes are found only on moist lesions such as the chancre, mucous patches and moist papules.

The papular type of erythema multiforme may be mistaken for a lenticular papular syphilide especially as the eruption occurs with predilection on the face and upper extremities. The onset of ery-

thema multiforme is, however, apt to be more sudden, the lesions are of a brighter red color and subjective symptoms (especially a burning sensation) are present. Some cases of erythema multiforme are accompanied at the outset by a varying degree of constitutional symptoms and the eruption shows a tendency at least to recurrence. It runs a shorter and more definite course (two to four weeks) and disappears without leaving pigmentation, so often noted after involution of the papular syphilide (Fig 4)

Scaling is at times a marked feature of papular syphilides, causing them to closely simulate psoriasis. A classic case of untreated psoriasis with profuse scaling of the silvery white, micaceous type, should not be very difficult to recognize. The appearance of psoriasis, however, varies greatly after involution has begun and especially after the scales have been removed by soap and water or greasy applications. The syphilitic eruption is more apt to be seen on the flexor while psoriasis favors the extensor surface. The lesions of syphilis tend to be more uniform in size. The scaling in syphilis is more delicate, more adherent and is not apt to cover the entire area as in psoriasis. A characteristic picture is also presented by the little collarette of scales often seen at the border of syphilitic papules. There is greater infiltration in the syphilitic lesions, the thickness of the patches of psoriasis being largely due to the amount of scaling present. The lesions of syphilis tend to be of a lean ham color while those of psoriasis are of a brighter red color. On removal of scales, bleeding points are less easily produced in syphilis than in psoriasis. Finally there is absence of itching as a rule in syphilis, which might also be true of psoriasis, though in some cases of the latter disease the lesions are severely scratched (Figs 5-9)

The flat papular syphilide is relatively uncommon. A type of special interest is that which forms circular lesions by peripheral extension with hyperpigmentation of the central portion. Rings of this type may be partial or complete. They are formed by enlargement of a single element as opposed to those of late syphilis which are due to a circular grouping of individual nodules. The annular or circinate (the words are synonymous) syphilide formed by a single papule is distinctly an early or first year manifestation of the disease. It is seen much more frequently in the negro than in the white race and constitutes, in my opinion, a racial characteristic

FIG. 1



Macular syphilide, showing profuse eruption of dull reddish, ill-defined lesions with no scaling

FIG. 2



Pityriasis rosea showing profuse eruption of slightly scaling rather ill-defined macules. No evidence of itching in this case

FIG 3



Lenticular papular syphilide showing some confluence of papules which were dull reddish in color.

FIG 4

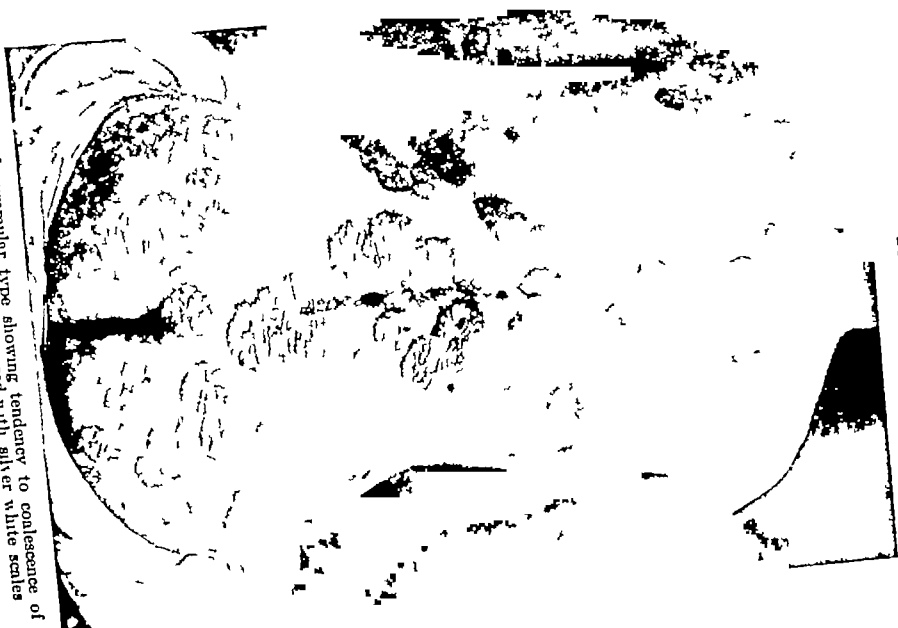


Frithema multiforme of papular and erythematous type of a brighter red than that of syphilide.

FIG 5



Papule squamous spherule showing profuse eruption Lesions mostly discrete and incompletely covered with grayish scales



Portions of nummular type showing tendency to confluence of patches which are completely covered with silver white scales

FIG 7



Nodular syphilids of crenate type. Nodules dull reddish in color and distinctly infiltrated

FIG 8



Periosis of crenate type. Lesions of brighter red color than in syphilis and infiltration slight

FIG 9



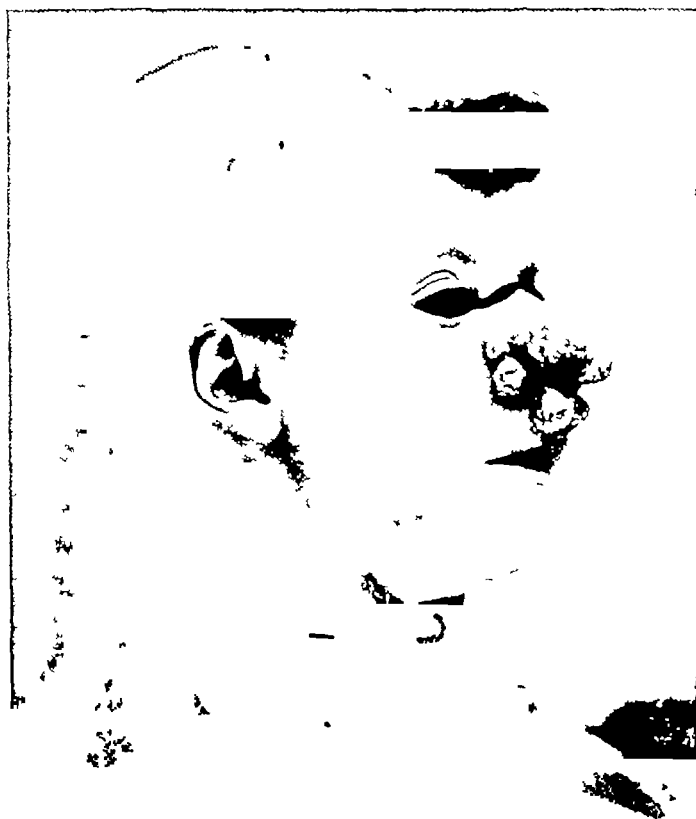
Nodular syphilide showing active lesions and scarring of greater part of back. Scars soft and comparatively inconspicuous.

FIG 10



Burn of third degree showing hypertrophic disfiguring scars

FIG 11



Nodular syphilide showing fairly firm lobulated mass chiefly affecting one side of the nose.

It is seen most often on the face, especially at the corner of the mouth and ala of the nose. In some cases the eruption may also involve the upper part of the trunk and arms. The rings vary in size from a split pea to that of various coins, and from coalescence often produce various gyrate patterns and at times concentric circles. The border is dull reddish in color and always raised. It is very thin and delicate in some cases and thicker in others. The central portion is deeply pigmented, the color persisting for months after the elevated border has undergone involution.

The diagnosis of the annular syphilide is usually easy for those who have had experience with skin diseases in the negro. It is, however, not infrequently mistaken for ringworm. The diagnosis may be easily settled by the microscope as in circinate ringworm it is a simple matter to demonstrate fungus. Furthermore in a reasonable number of cases of ringworm there are tiny vesicles on the elevated border. The diagnosis is settled by concomitant symptoms and a positive Wassermann test as the annular syphilide appears in the early period of the disease when the Wassermann test is strongly positive. As the annular syphilide occurs predominantly on the face it could hardly be mistaken for pityriasis rosea, the latter being chiefly seen on the trunk. Seborrhœic eczema, which may occur in circles, is usually accompanied by more or less profuse eruption of the scalp. Impetigo contagiosa may also present a circinate form at times. The border of the lesions, however, is not elevated and presents a shiny moist appearance after removal of crusts.

Polymorphism is a characteristic feature of the early syphilides, the lesions frequently showing two or more distinct types, such as macules and papules or papules and pustules. There are often hybrid forms spoken of as maculo-papular, papulo-pustular, etc. A peculiar variety of the last mentioned form is the frambesiform syphilide which may closely resemble *frambesia tropica* (yaws). This eruption is rare and consists of single or coalescing papules covered by crusts, the removal of which leave a reddish, raw surface suggesting the appearance of a raspberry. The differentiation of syphilis and yaws is not always easy as both diseases are due to spirochaetes which are morphologically similar, both give a positive Wassermann test and respond to treatment by the same remedies. Yaws, however, is a strictly tropical disease, endemic in certain

regions and occurs chiefly in dark races. The infection occurs most often in children, on the exposed parts of the body and is never present at birth. There may or may not be an initial lesion. If present it is likely to be of the same type as the later or so-called secondary lesions. There is no constancy in the involvement of the lymphatic glands. That the diseases are separate entities is proven by the fact that infection with one confers no immunity to the other.

Pustular syphilides are somewhat later manifestations than the macular or papular eruptions and occur usually in the first six or eight months of the disease. They are not very profuse as a rule and occur with predilection on the back and extremities. They represent the only type of early syphilide which is destructive in character, often leaving a variable amount of scarring. They frequently occur in persons whose general health is below par and are seen in hospital rather than in private patients. In my experience they occur more frequently in negroes than in whites. Pustular syphilides are described in the classification of my father, Dr. George Henry Fox, as acuminate, obtuse and ecthymoid. There are essentially two distinct clinical types, the acuminate and flat.

Acne may be mistaken for the acuminate pustular syphilide. It is limited to the face, chest and upper two thirds of the back, the pustules have a more inflammatory appearance and the essential lesions of the disease, the comedones, are present. The frequent history of long duration and the age of the patient is a help in diagnosis.

Small-pox may be closely simulated by this type of syphilis, the differential diagnosis being naturally of great importance. More than one patient with an acuminate pustular syphilide has been quarantined for supposed variola while small-pox has at times been mistaken for syphilis. The location of the pustular syphilide favors the trunk though other parts may be affected. Variola, however, is present in greatest profusion on the face and distal part of the extremities, especially the back of the hands and forearms. Syphilitic lesions may be pustular from the outset. Those of variola are papular at first, of a deep seated "shotty" type and pass through the well-known vesicular and pustular phases with characteristic umbilication. The lesions of syphilis are more likely to vary in size and type and new ones appear from time to time. Variola runs a more

regular course, the lesions at a particular time being practically of the same type. In syphilis the constitutional symptoms, including fever, are mild. In small-pox there may be a history of fever and headache preceding the eruption and a recrudescence of fever during the stage of pustulation. The presence of concomitant lesions of syphilis and a positive Wassermann test are of great assistance in diagnosis.

The flat types of pustular syphilide may resemble impetigo or ecthyma, the former being spoken of as the impetigo-like or obtuse, and the latter the ecthymoid syphilide. Both are rather infrequent. The impetiginous type consists of flat, discrete, pea to finger nail sized lesions showing a tendency to coalesce and to cause a profuse amount of crusting. This eruption may be fairly generalized but as a rule is localized about the face, genitals or scalp and is apt to occur in association with other skin lesions of syphilis. This type may be confused with impetiginous (pustular) eczema or impetigo. Eczema invariably causes some itching though it is true that the pustular type is far less pruritic than the papular or vesicular forms. Eczema never causes ulceration beneath the crusts, while ulceration, at least of a superficial type with resulting scars, often occurs in the pustular syphilide. Impetigo is differentiated by its shorter course and the lack of other manifestations of syphilis.

The ecthymoid syphilide is an uncommon manifestation, the eruption appearing most often on the shoulders, back and extremities. The lesions are generally few in number and are apt to cause a considerable amount of ulceration and scarring. Ordinary ecthyma is seen most often on the lower extremities, is of shorter duration and is a much less destructive process.

The late syphilides are characterized by destructive lesions which tend to break down and ulcerate and almost invariably produce scars. They appear most frequently three or four years after infection though they may not occur till twenty or more years have elapsed. In contradistinction to the early eruptions which are generalized and symmetrical, the late syphilides are more or less localized and conspicuously asymmetrical. They consist of essentially similar lesions known as nodules or tubercles when small, and gummas when large. The lesions may appear in groups or form characteristic circles and portions of circles. The circinate configuration is due to

the presence of several individual lesions and not to the peripheral enlargement of a single lesion as in the case of the early annular syphilide, previously described. The tendency to ulceration is always present, especially in the larger lesions (gummas). For the recognition of the late syphilides, reliance must often be placed on clinical evidence as in this stage the Wassermann test is frequently negative.

Lupus vulgaris offers perhaps the greatest difficulty in diagnosis. In some cases it is practically impossible even for the most expert clinician to differentiate between lupus vulgaris and a nodular syphilide. The Wassermann test may be negative and even a histologic examination may not decide the question. It then becomes necessary to rely on the therapeutic test. In a classic case of lupus vulgaris of the flat type without ulceration or appreciable scaling, the diagnosis may easily be made from the presence of characteristic "apple jelly" nodules. In the hypertrophic and serpiginous types the similarity to the nodular syphilide is almost complete. Lupus as a rule begins in childhood or early adult life while the late syphilide usually occurs at a later age. The course of lupus is also extremely slow and there is little tendency to spontaneous healing as compared with the nodular syphilide. Lupus has a characteristic tendency to destroy the cartilage of the tip of the nose, causing a beak like appearance. Scars due to lupus may be more or less thick and deforming while those of syphilis are notably thin, papery and much less disfiguring.

A well developed case of nodular leprosy could hardly be confused with syphilis. In the early stage however, showing only a few scattered nodules and only slight nerve involvement, the diagnosis may be in doubt. The nodules of leprosy present various shades of dull red and yellowish brown rather than the classic lean ham color of syphilis. They tend to be roughly symmetrical and run a progressive and chronic course. The Wassermann test is not conclusive as it is frequently positive in the nodular type of leprosy.

Rosacea at times simulates the nodular syphilide rather closely. Both diseases are more apt to be seen in persons of middle age and both in fact may occur together. Rosacea is localized on the middle two thirds of the face and is symmetrical. The nodular syphilide invariably shows a tendency to be asymmetrical and is less inflam-

matory in appearance than rosacea. In the latter disease there is usually a history of gastro-intestinal disturbance. In the accompanying illustration a nodular syphilide of the nose is shown which might be mistaken for rhinophyma except for the fact that this type of rosacea is practically never seen in women and that the lesions in this case were decidedly asymmetrical (Fig 11).

Varicose ulcers of the legs are not infrequently mistaken for an ulcerating gummous syphilide. Varicose ulcers are usually single, occurring in most cases on the antero-lateral aspect of the lower third of the leg. In addition to their association with varicose veins a diagnostic point is the large amount of brownish pigmentation which is usually present in the surrounding skin. Syphilitic ulcers are likely to be multiple and have a sharply punched out border with little surrounding pigmentation.

Erythema induratum (Bazin's disease) may easily be mistaken for the gummous syphilide. The former is seen, however, almost exclusively in girls or young women at an age when late syphilis would be uncommon. The process in Bazin's disease is indolent, the discharge from the ulcers slight and the distribution is roughly symmetrical. The course of a gummous syphilide is more rapid, the ulcers have a purulent discharge and are apt to be unilateral. They may also show a tendency to grouping in a circle or portion of a circle.

In the differentiation of epithelioma from nodular or gummous syphilide, the age of the patient, unless advanced in years, is not of much diagnostic importance. In general, the course of syphilis is much more rapid. Of great importance is the cartilaginous infiltration and waxy appearance of the elevated border of epithelioma. If ulceration is present, the secretion is slight as compared with syphilis, and bleeding on slight traumatism is frequent. At times the clinical diagnosis is impossible and the question has to be settled by histologic examination. A positive Wassermann test is not conclusive as both conditions may coexist, cancer arising on the basis of a syphilitic process. To resort to the therapeutic test in such a case is not advisable when a much quicker and more certain diagnosis can be made by the microscope.

Syphilitic eruptions of the palms and soles are to be sharply

differentiated between the early and late manifestations. Those occurring early are of the maculo-papular type, consisting of discrete, non-elevated and often scaly lesions. This type, while very characteristic is not as common as is generally supposed. A profuse eruption of this type is certainly uncommon.

Early syphilides of the palms and soles are nearly always part of a more or less generalized eruption and are invariably bilateral. In very rare instances erythema multiforme may appear on the palms, without affecting any other part of the upper extremities. Such a type consists of discrete macules which from their appearance alone cannot be positively differentiated from syphilis. I recall two striking cases of this kind which were associated with bullous lesions of the mouth and caused a mistaken diagnosis of syphilis. In these cases there was a history of recurrence and negative Wassermann test.

Late syphilides of the palms and soles may occur as circinate scaly patches (often in the centre of the palms) or as diffuse, dry, scaly patches, closely resembling eczema, psoriasis or the eczematoid type of ringworm. The most important point in differentiation is that late syphilides of the palms or soles are unilateral in probably nine cases out of ten. Furthermore, there is no itching and the patches are more or less sharply demarcated. In eczema the patches are bilateral, show no sharp demarcation and may be somewhat itchy, though itching in this location is not a prominent symptom of eczema. Many cases which were formerly classed as eczema are now known to be simply "eczematoid ringworm" and are generally called dermatophytosis. The borders of the patches in this condition are more or less sharply defined and, like eczema, the eruption is bilateral. Theoretically we should be able to demonstrate fungus with great regularity, but experience shows that this is often difficult either by direct microscopic examination or by culture. Psoriasis may also simulate late syphilis of the palms and soles. It is, however, bilateral as a rule and except in very rare cases is accompanied by psoriatic lesions in other locations such as the scalp, elbows and knees, and nails.

Alopecia may occur in either early or late syphilis. Alopecia in the early stage consists of a diffuse thinning of the hair, which is seldom perceptible to others in spite of the fact that it is often the cause of great apprehension to the patient. The characteristic type of alopecia which is unusual, occurs during the first or even second

year and is patchy in character and often described as "moth eaten" in appearance. Loss of hair in the late stages is due to ulceration and is permanent. This is a rare occurrence.

Alopecia areata is the only disease which may simulate the patchy baldness of early syphilis. In neither condition is there any redness, scaling, or change in the texture of the scalp. The patches of alopecia areata are usually more definitely bald and not as generalized as those of syphilis. The new growth of hair in alopecia areata is devoid of pigment at the outset. While some have thought that syphilis plays a part in the causation of some cases of alopecia areata, there is little, in my opinion, to support this view. Ringworm is distinguished from syphilitic alopecia by the presence of scales, broken hairs or "stumps" containing fungus and some suggestion, at least, of redness. Folliculitis decalvans shows definite atrophic scarring.

Scars are often of great value in the differentiation of syphilitic and non-syphilitic eruptions. With the exception of the pustular syphilide none of the early eruptions leave any scars or other permanent trace. Scarring is chiefly produced by the late destructive nodular and gummous syphilides. This often happens in non-ulcerating lesions and is the invariable result of those which ulcerate. The scars of syphilis are often very characteristic in texture, configuration and grouping. In general, they present surprisingly little deformity in proportion to the size and extent of the lesions which precede them. Such scars are of the atrophic type, often thin and wrinkled, resembling "cigarette paper." Like most scars they are dull reddish or purplish at first and eventually assume an ivory white appearance. Characteristic forms include circular, semicircular, kidney, horseshoe and S-shaped lesions. A feature of great diagnostic importance is that no active lesions develop in syphilitic scars, whereas this is common in cutaneous tuberculosis and cancer.

As opposed to the soft pliable and relatively non-deforming scars of syphilis, those of severe cases of lupus and burns are often deforming, tough and banded in character. The pitted scars of small-pox, acne, acne varioliformis, and herpes zoster are as diagnostic of these diseases as the original lesions which produced them.

Medical History

LUKE THE PHYSICIAN AND HIS WRITINGS

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"LUKE, the beloved physician, and Demas, greet you," wrote Paul to the Colossians some nineteen hundred years ago when for the first time he, himself, was "the prisoner of the Lord" nominally under Nero in Rome, in his letter to Philemon, he wrote, "There salute thee Demas and Lucas, my fellow laborers", and again, to Timothy, from his Roman prison, shortly before sealing his confession with a martyr's death, "Demas hath forsaken me only Luke is with me" These are the only passages in which Luke's name is mentioned in the New Testament, and yet there remains not even a plausible doubt as to his authorship of the gospel which goes by his name and of the book of the Acts

Too many of us of the medical profession, I opine, are neglectful of our distinguished heritage in this Doctor Luke and his writings which form so integral a part of our New Testament, voluntarily classifying ourselves with a man who continues to live in poverty with a large bank account available which, properly invested, would yield him a substantial income

Luke also has a strong and a wider claim on the vast gentile world in particular, as the only New Testament non-Jewish writer, evident from his name as well as from his enumeration in the Epistle to the Colossians in a group apart from those "who are of the circumcision." He is comparable in this isolation and honorable exception with Job in the older Hebrew Scriptures

That Luke was a doctor of medicine was not questioned for eight centuries, his doctorate has latterly been securely established by the painstaking life-long comparative studies of the early Greek medical literature by William Kirk Hobart of Trinity College, Dublin (1882), who has shown that the interests of the author and his

invariable viewpoint are those only possible to a trained physician, while the diction throughout all his writings is more replete with medical terms than that of any eminent medical man of our own day who discusses lay matters. His medical sympathies, naturally most manifest in the miracles of healing, become peculiarly evident when contrasted with the parallel passages of his lay brethren, Matthew and Mark. That Nestor of Biblical critics, Adolf Harnack, is emphatic in holding this mooted question as settled beyond any reasonable peradventure.

It is evident in this era of our so-called Christian civilization, when the New Testament narratives are circulated by countless millions in hundreds of tongues, that this ancient physician, Luke, is actually more read, and read in more languages, than any or all subsequent authors, sacred or professional. It would seem, therefore, that we, his colleagues of a later day and generation, should reckon this great progenitor as *facile princeps* our patron saint, we owe it to the dignity and reputation of our profession to study attentively the writings, life, and history of this eminent *doctor medicinæ* as one who has exercised a more profound influence upon the minds and conduct of men than all the writings of all other physicians who have lived in the last two milleniums.

It was the privilege of Luke in his gospel to trace the history of the Christ from the announcements to Zacharias the priest and to the virgin mother Mary antecedent to his birth, on down through his childhood and through his manifestation to the world in the years of his ministry, to his sacrificial death on the cross and his resurrection. Following these memorabilia, he has in the Acts depicted the origin and establishment of the orphaned but waiting church, the advent and vicegerency of the Holy Spirit, and the witnessing of the disciples extending out through Judea, Samaria, Asia Minor, Greece, and Rome—the record of a Christian church upon earth in the midst of an often bitterly antagonistic world, producing finally the nearest approach to a true civilization the world has ever seen.

Let us for a moment try to determine what considerable portion of the arch of the Christian faith we owe to our gentile doctor, Luke, in the New Testament Pentateuch, the four gospels and the Acts. I proceed to count the pages in my Westcott and Hort Greek Testament in order to estimate the percentage contribution of each—

Matthew, Mark, Luke, and John There are 306 pages in all in the five books, of these Luke in his gospel contributes 72 and in the Acts, 69, or about 46 per cent of the whole! The remaining 54 per cent is divided among the other three writers Limiting our count to the four Gospels, we find there are 235 pages, of which Luke in his gospel has written 72, or about 30 per cent, considering only the three synoptics—182 pages—Luke wrote 40 per cent Thus from a mere numerical computation, we become aware of the preponderating importance of his writings, and in several senses he is a *primus inter pares* As to the question of quality, who will be bold enough in a matter so vital to say that one takes precedence over another, where each was commissioned to paint a picture of him who is both Son of God and Son of Man, our Kinsman Redeemer, the representative head of the new race of first born ones

When read for the first time as a mere record of facts, the four Gospels appear much alike with considerable repetition of sundry familiar scenes, exhibiting but minor differences, a closer study, however, reveals a vast divergence in the scope and purpose of each of the four albeit with a great underlying harmony Luke's immediate object in his gospel was to establish his "most excellent Theophilus" (loved of God or loving God, either or both, possibly an assumed loving Christian name to hide the identity of a Roman official) in the certainty of his Christian faith Note the remarkable introductory of forty-two words in the Greek, without the slightest conscious or apparent effort, our doctor simply, directly, and naturally gives us more reasons for the scientific basic solidity of his convictions as to the absolute verity of that which he is about to relate than any other writer, in any age, has ever expressed with a like succinctness and certitude about any important matter whatever commanding his attention. I may perhaps here admit on a parity the impressive, revelatory, opening verses of the First Epistle of John, which contain also in a superlative measure all that is essential to the competency of a trustworthy witness Let me skeletonize this proemium for emphasis "Things most surely believed among us—delivered unto us—from the beginning—eye-witnesses—ministers of the Word—it seemed good having had a perfect understanding—of all things—from the very first—to write in order—that thou mightest know the certainty—of things wherein

thou hast been instructed ” Then follow the facts in twenty-four chapters expanding and expatiating upon the fundamental purpose, the evangel, common to each of the gospels, proclaimed by our Lord in his very first sermon (Luke 4 18) and in his final visit in the house of Zacchaeus, at the end of his pilgrimage—“For the Son of Man is come to seek and to save that which was lost ” Luke uses the verb “to evangelize” twenty-five times, to once in the other gospels

The object of the Acts, also dedicated in continuation to the same Theophilus, leaps up to the eye in the first verse, by simply placing emphasis on the word “began,” thus declaring that Jesus who had companied with them for three years in person, though now invisible still continues his work through his vicegerent the Holy Spirit, working in and through all his true followers, age after age

Luke deals manifestly with transcendent truths As an introductory to these I would direct attention to an encouraging new note in the writings of some of our eminent scientists, who urge the true scientist fearlessly to declare observed facts, however much they vary from previous experience and common opinion, Sir Oliver Lodge in “Modern Scientific Ideas” advises, “Always be guided by experience and be loyal to facts, whether we understand them or not ” Sir William Bragg also recently uttered a similar note as president of the British Association for the Advancement of Science

Jesus nearly two thousand years ago enunciated the basic rule of the laboratory and of all scientific investigation and discovery at the very outset of his career when he said to the inquiring disciples, “Come and see ” Hippocrates was greater than Plato or Aristotle when he also laid down the law of medical progress in three words, *tribe meta logou* cultivate living contacts with a matter, develop familiarity, acquire experience, and then do your reasoning and form your judgments Paul, Spirit-taught, says in a direct, simple, practical way, “Prove all things, hold fast to that which is good ” On this basic principle acted Doctor Luke, cautious scientist that he was, setting the example ages ago, when he followed up his terse scientific introduction with a record of an angelic visit to Zacharias, and to the virgin Mary, promising to each a child miraculously born. The heavenly visitant concluded his declaration

to Mary with the statement, staggering to our materialists, "For with God nothing shall be impossible" An unregenerated world had still to pass through the degenerate Middle Ages and await the advent of Roger Bacon, Tycho Brahe, Galileo, and John Hunter, before it accepted this salutary maxim as its open sesame to the secrets of nature

As we read the Gospel and marvel at the twenty miracles therein recorded, we must recall Luke's repeated observations of miraculous events as he traveled with Paul, even including the raising of the dead (Eutychus at Troas), a mind so prepared, and believing in the deity of Jesus, obviously does not balk at but rejoices in the miraculous as necessary evidence

In broad outline as noted, the three synoptics—Matthew, Mark, and Luke—are strikingly similar, in each, Jesus, the Son of God, comes among us and takes our human nature upon himself by an earthly mother, and in each we have the record of his life, his deeds, his teachings and the hostile reactions of the world, the flesh, and the devil, culminating in his death and his resurrection This simple theme, however, becomes wonderfully varied as related in each of the gospels

For the sake of my interested medical colleagues, let us analyze Luke's gospel more closely

The political world of the great Roman government is in evidence as a mere timekeeper, the dial of the clock as it were, for these far greater events (Chap 2 1-5 and 3 1-3) Luke's first three chapters record our Lord's birth and draw us into the sweet and yet profound intimacies of his home life and his bringing up, concluding with his genealogy traced back to Adam, the fountain head of the human race Then from chapters 4 to 8, our Lord mingles freely with the Galilean world—Son of God with power to forgive sins and Son of Man accepted by some but rejected by the hierarchy, journeying about with his disciples who are unwittingly at school for two years and a half preparing for their later work. From chapters 9 to 21, at last fully recognized by the disciples as the Christ (Messiah), we have what we might call their six-month, intensive university course, a daily clinic with many spiritually pathological cases brought before them, the material often being furnished by his opponents—Pharisees, lawyers, and Sadducees—our

Lord's use of them recalling the declaration of old, "Surely the wrath of man shall praise thee, the remainder of wrath shalt thou restrain" Chapters 22 and 23 consummate the tragedy of his sacrifice on the cross for our sins, so utterly unexpected by all his followers but from the first anticipated by him, for "Thus it is written and thus it behooved Christ to suffer and to rise from the dead the third day" (Chap 24 46) The concluding act in the great drama in chapter 24 is the conquest of death in his resurrection and his ascension on High Then follow the book of the Acts of the Spirit-endowed infant church and the fourteen Epistles of Paul, Luke's intimate associate

Let us now note some special characteristics of this gospel by our proto-evangelist-physician

Of particular interest to us as doctors are those unavoidable medical traces Luke has naturally left in his writings, so numerous are they that it is at once evident that a doctor of old, of whom but for the gospel we would never have heard, was fully as immersed and interested in his calling as any doctor in our own day and generation To expatiate in detail upon this important subject would call for a substantial volume, we, therefore, confine ourselves to a few pregnant excerpts

In Luke, Peter's wife's mother had the great fever, a term distinguishing the more serious and threatening from the group of lesser fevers Our Lord "stood over her and rebuked the fever, and it left her and immediately she arose and ministered unto them" Mark only tells us that she was in bed with a fever Luke gives us a clear picture of the leper's condition when he tells us, "And it came to pass when he was in a certain city, behold a man who was full of leprosy," much as if we were to say that a small-pox victim had the confluent form, an enlightening diagnosis and prognosis for a doctor Here Jesus "Put forth his hand and touched him, saying, I will be thou clean And immediately the leprosy departed from him" In the first chapter of Mark, it is simply, "And there came a leper to him" Luke uses the doctors' term for the paralytic who was let down through the roof because of the crowd, which is *paralelumenos*, while Mark uses the term of the lay world, *paralutikos*, which is reflected into English as paralytic. The trained physician notes the associated facts and naturally paints

a more striking picture in his fuller details Luke tells us in chapter six of one of the early miracles in the synagogue, which gave offense because it was done on the Sabbath day, that it was the man's right hand that was withered, while Mark simply tells us that the man had "a withered hand" Similarly, long after, when the multitude arrested Jesus in the garden, Luke, seeing a remarkable medical (surgical?) miracle, tends more to orient a doctor's mind when he relates that, "One of them smote the servant of the High Priest and cut off his right ear And Jesus touched his ear and healed him", Mark only notes that "One of them that stood by drew a sword and smote a servant of the High Priest and cut off his ear" and adds no more, and John labels Simon Peter as the impetuous man, as indeed we might have guessed In the case of the demoniac in the Gergasene country across the Sea of Galilee, Luke adds that for a long time he wore no clothes Aetæus, closest in spirit and method and as a clinician to Hippocrates (F H Garrison), notes this as one of the characteristic signs of madness Of the woman cured of her issue by touching our Lord's garment as he went with Jairus to heal his daughter, Luke writes that, "Immediately her issue of blood was stanchèd," using sharply defined medical terms paralleled by Hippocrates and Dioscorides, Mark only says, "The fountain of her blood was dried up and she felt in her body that she was healed of that plague" In the cure of the epileptic after the transfiguration, Luke, the father cries out, "Master I beseech thee look upon my son for he is my only child" The word for "look upon" (*epiblepein*) is the medical term for seeing and going carefully into a case

Harnack, who closely follows Hobart whose lists I consult repeatedly, says in conclusion that the majority of Hobart's some three hundred distinctive references "plainly reveal the pen of a man who was either a physician himself or had a special interest in medicine," for in these narratives where they are paralleled in Mark's gospel, the different words used by Luke "are most simply and surely explained from the professional interest of a physician Indeed I cannot see that any other explanation is possible"

In the miracles peculiar to Luke, the raising of the widow's son at Nain, the healing of the woman who was doubled over for eighteen years, and the man with dropsy, as well as in the parables

of the good Samaritan and Dives and Lazarus, in addition to the healing of the lame man at the gate beautiful and of Æneas, of Tabitha, and Saul's blindness, the lame man at Lystra, and the account of Elymas the sorcerer smitten blind, and the vision of Peter, "Everywhere in the stories (which are moreover remarkable for their fulness of detail) traits appear which declare the interest or the sharp eye or the language of the physician" (A. Harnack)

In the account of the man who fell among thieves and was left half dead (*hemithane*), the expression is paralleled in Galen Touching this man's treatment by pouring oil and wine into his wounds, as Harnack notes, the arch critic Wellhausen, in a moment of intensely applied autoschediastic ratiocination, somewhat superciliously indicted this dogma, "Into a wound one pours oil, but not oil and wine," a curious lapse of a hypercritical astute mind, for the ancient practice was not uncommon in the treatment of wounds and sores (*testibus Hippocrates, Dioscorides, Galen, and Aretaeus*)

The story of the lame man in Acts 3 is another instance in the long list, showing indubitably the hand of the physician Luke says, "And he took him by the right hand, and lifted him up and immediately his feet and ankle bones received strength And he, leaping up, stood, and walked, and entered with them into the temple, walking, and leaping, and praising God" Elsewhere he supplies the important addenda that the man was lame from his mother's womb, and in 4 22, notes with emphasis, "For the man was over forty years old" on whom this miracle was shewed A passage from Galen's "Medicus" serves to illuminate the peculiarly anatomical terms

For one who would further analyze the gospel in order to come into closer touch with the writer, I would suggest several lines of study easily carried out Even those little words we are so prone to pass over without remark, when repeated may become indices of tendencies as straws mark the flow of a current

For example, the word "certain" runs through the gospel from the first to the last chapter Its slight vagueness and its constant use reveal a gospel written for one not familiar with the geography of the distant Palestine country It is also evident by this token that it is for the average person we meet daily on Main Street and wherever we are, at all times, under all circumstances So it came

to pass that it was "a certain priest," "there was a certain Pharisee," "a certain creditor," and "a certain woman," our Lord was in "a certain city," there was "a certain Samaritan," "a certain lawyer,"

A CERTAIN - LUKE

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17	18	19	20	21	22	23	24
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"a certain rich man," and so on. A certain man and a certain place are any man, every man, anywhere, at all times, so universal is our Gospel.

Note the miracles and the parables which form so large and important a part of the framework of the Gospels. Take first the miracles of healing and note their disposition. After the introductory first three chapters, these miracles are evidently far more

HEALING - LUKE

1	2	3	4	5	6	7	8
		
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abundant in chapters four to eight. This grouping is clearly evidential in character, our Lord appealing to man on the basis of his miraculous works according to prophecy, then after two years and a half of his ministry, the disciples make the great confession that he is indeed the Christ, the Son of God. At once now he begins to teach them by the more profound truths of the parables which as the miracles fade out come more and more into prominence in the narrative, ending with the parable of the fig tree prophetic of his return to earth to reign. The accompanying chart shows not only the actual miracles but every mention of healing, with the purpose of exhibiting the predominance of the miraculous element.

There are some twenty-seven parables in Luke, including as well the briefer ones. Aside from the parable of the two debtors

in Simon's house and of the sower, all the more formal parables, some twenty-one, are found in the last chapters. Associate the increasing opposition of the hierarchy determined to destroy him

PARABLES - LUKE

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with the use our Lord made of his enemies to give his disciples some of their most important instruction

Is not this arrangement that of life? First miracles, then parables, first, come, see, and be convinced, then, sit down and learn like a child. Such, too, is the lesson of Martha and Mary, peculiar to Luke, first hear and learn and then do (Chap 10)

One of Doctor Luke's most striking teachings is that of our Lord as a man of prayer, shown in the accompanying graph which

PRAYER - LUKE

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notes every mention of prayer. The underlined dots refer to our Lord's own prayers, seven of which are not mentioned elsewhere than in Luke. If to this list we add those of the other gospels, it becomes evident that his life was passed in an atmosphere of prayer.

Luke's gospel, more than any other writing ever penned, gives woman her position in a christian community. The heathen world was ashamed to speak of its women, and the Jew regularly prayed, "O Lord I thank thee that I was not born a woman!" It was common in heathen lands to destroy female infants at birth. On the graph, I have recorded every occasion when woman is mentioned, note the significance of this in the whole narrative. Nowhere is

woman obtrusive, her function is not public, executive, or governmental. The one great transgression where a woman takes the initiative is that of Herodias who murdered John the Baptist (*qui facit per alium, facit per se*). One concludes from careful study of this gospel that the position of woman here as in the world at large is a vitally necessary complement to that of man. If man stands for incessant activity and force, woman represents grace, the

WOMEN - LUKE

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virtues of the home life, and the heart. Which shall we call the greater where both are indispensable?

Doctor Luke's graphic pictures have so thrilled the guild of painters that he is accounted their patron saint, and art took its birth in the canvases of the mighty painters of old depicting the Gospel and the Acts. His, too, is the gospel of song as well as of angelic visitation and the triumphant recognition of the new bond uniting heaven and earth. It is important, however, to realize that the purpose of Luke's writing does not lie in all these and many other excellencies but in his manifest desire to glorify the Christ, the Son of God, and himself to subscribe with Paul, "Whose I am and whom I serve," or again, as "Paul a servant of Jesus Christ" (Rom 1 1), and "James a servant of God and of the Lord Jesus Christ" (Jas 1 1), and "Simon Peter a servant and an apostle" (2 Pet 1 1). Luke's is the exposition of "the gospel of the grace of God" offering a salvation full and free to all men in all ages. Here is the one physician in the heathen world who recognizes the Great Physician (Luke 4 23), yields his life wholly to him, and is inspired to produce "the most beautiful book in the world" (Renan). Luke's finding of Christ was no loss of identity or lessening of his personality, on the contrary, both were enriched and enlarged to the utmost. His effective appeal is to all men everywhere—Go thou and do likewise, he who refuses and neglects the opportunity thus offered us in this life suffers incalculable loss.

Medical Biography

LESSONS TO BE LEARNED FROM THE WORK OF FRIEDRICH KRAUS

By I W HELD M D

New York

ON MAY 31, 1928, the renowned clinician, Friedrich Kraus—still in the prime of life and possessing an abundance of physical and mental vigor—celebrated his seventieth birthday. As it is customary to review the achievements of a person of eminence upon his arrival at the Biblical age, this was the occasion for both medical and non-medical men throughout Europe to express their appreciation of him. His pupil and successor, von Bergmann, and his pupil, Theodor Brugsch, who, because of their long association with him, knew Kraus best, rendered most interesting accounts.

By offering a similar evaluation of Kraus to the profession of this country, I am fully aware of the fact that I am availing myself of a great privilege. That it was my good fortune to spend eight semesters, between 1908 and 1927, in the lecture hall and often in the wards with Kraus is my justification. Nevertheless, I approach the summary diffidently, knowing well that, were I fortunate enough to have been the pupil and friend through thrice that long a period, I must still fall short of the goal, inevitably. It is impossible to evaluate a man who has been so signal an illustration of the extent to which one in the medical profession may serve the scientific interests of his pupils, infusing them with his enthusiasm, and inspiring all who come in contact with him.

My desire is not to praise, because praise is painful to the modest Kraus, but, rather, to point out, in some measure, that it is the personality of Kraus as a chief, a teacher, and a clinician which has made his clinic, his pupils, and himself supreme examples of their kind in the scientific world.

* * *

Friedrich Kraus was born on May 31, 1858, to parents in moderate circumstances. His birthplace was the ancient city of Prague, where mediæval history is uncovered in a glance, and here he obtained his preliminary and university education.

He showed unusual aptitude in his studies and evinced a decided interest in the laboratory, clinic and library. Because he was so diligent, while yet a student he had the rare privilege of becoming a director of the library. Although vigorous, he was not inclined toward sports. So his face, differing from the faces of most university students on the continent, is not sabre-scarred.

Following his graduation, he continued his studies of chemistry, biology and physiology. He did so with so insatiable a hunger for knowledge that he attracted the attention and became the idol of Hupper, Chiari and Macht, all of whom remained his lifelong friends. Kahler, the celebrated clinician in the University of Prague, noticed Kraus's work, too, and engaged him as his assistant. Kahler—whose picture hangs in Kraus's study—was not only a great chief, but a kind chief. So strongly did the gentle character of the elder man impress the plastic nature of the youth that, when Kraus himself became a teacher, his kindness exceeded that of his preceptor.

A short time after Kraus's appointment, Kahler was called to the Chair of Medicine in Vienna. He took Kraus with him but, unfortunately, Kahler soon developed an incurable malady. He entrusted himself to the care of his young assistant, and, eventually, Kraus had to close the eyes of his beloved teacher and chief with his own hands.

The fame of Kraus, during the short period he was Kahler's assistant, had reached such a height that it was expected he would be called upon to take the place of his chief. When Chvostek was selected, it was a great disappointment to most members of the faculty. The one who would have been affected most by the appointment, however, rejoiced that he had not received it. His apprehension that, if selected, he could not have filled the position effectively, had been great.

Happy with the outcome, Kraus now accepted the Directorship of Rudolph's Spital and launched upon the monumental work he has carried on throughout his entire teaching career, namely, his research into that vastly important subject, *the rôle of constitution in disease*.

During his activities in Rudolph's Spital, he came in contact with a large number of American medical men. A mutual admiration soon developed between them and Kraus. He seemed to make an almost immediate spiritual contact with them—they loved him and he loved them. Two whom he regarded most highly, and for whom, in after years, he never ceased to inquire, were Dr. Van Horn Norrie, now a Director of Internal Medicine at Bellevue, and Professor of Clinical Medicine, Columbia University, and the late Professor Hoover of Cleveland.

During Kraus's Viennese period, American postgraduates did not have the medical training they have today. Nevertheless, Kraus was so impressed by their ability to learn and apply what they learned, not empirically, but with a scientific reason for each act, to the problems in hand that he prophesied America's leadership in many branches of science, particularly in chemistry.

"Europeans will have to be very diligent," he burst forth, dramatically, one day, "if America is not to outdistance them. *Lead America must*, but we must not lag too far behind!"

Whenever, during his teaching years, he had occasion to mention an American author in any branch of medicine, he did so with the greatest warmth and enthusiasm. His only apprehension was as to how we might develop as clinicians, since we are reputed to be such a busy people. He was afraid we would call upon mechanical devices at the expense of mental quality, and so reach a stage of over-specialization. That this prophetic truth is one that must be heeded has been pointed out by Osler, more recently by Peabody, of whom we were bereaved so untimely, and, lately, by Du Bois of Cornell. He foresaw that the trend of a mechanical age would be to divide the human body into innumerable parts, requiring a specialist for each.

When, in 1894, he was called to the Chair of Medicine at Gratz, and delivered his famous opening address, *Hippocratismus*, he voiced his conception of the totality of the human body boldly, and expressed his complete concurrence with the Hippocratic idea that it is the human being who is ill, and not an individual organ. He emphasized the fact that a trained clinician cannot afford to subdivide the body into many parts because of special mechanical devices for certain organs. He must work with as few methods as possible and utilize mechanical means only when absolutely necessary. During Kraus's

eight years in the University of Gratz, his clinic became known to the world, attracting many important associates, among whom were Scholz, Pfeifer, and Hans Eppinger

In 1902, the epochal period of his life began. He was called to the Chair of Medicine in the University of Berlin.

His inaugural address, *Exhaustion as a Sign of Constitution*, was, in reality, a continuation of his unforgettable address in Gratz nearly a decade earlier and an outline of the future work of himself and his associates to whom he said, "We must work hard in order to make our clinic great!" This plan, which was carried out to the utmost degree from 1902 to 1927, is considered in detail in an address, *Die wissenschaftlichen Arbeiten der II medizinischen Klinik der Charite*, which Theodor Brugsch delivered on the occasion of the unveiling of the bust of Kraus when he turned his clinic over to his pupil and successor, von Bergmann.

During Kraus's quarter of a century in Berlin, more than one hundred associates aided in the work of the clinic, contributing brilliantly and everlastingly to medicine in all its branches, and even to surgery.

Interesting as such a list might be, this is not the place to name all those who distinguished themselves. The names omitted are not less important than those enumerated, however.

Among the early assistants who won renown were Umber, Gerhardt, Jr., De la Camp, Mohr and Lippman. Eventually each was awarded a position as director of a hospital or was called to the chair of medicine in some other university. Unfortunately, De la Camp and Gerhardt died in the height of their activities.

Among the later associates who helped to establish the international reputation of Kraus's II Medical Clinic in Berlin, must be mentioned Theodor Brugsch, at present Professor of Medicine in Halle, successor to Volhardt, von Bergmann, Kraus's successor, Nikolai, the father of electrocardiography in Germany who, on account of political differences with the Hohenzollerns, was compelled to leave Germany and is now teaching medicine in South America, Pappenheim, the immortal, whose work on hematology was compared by the late pathologist, Orth, to Virchow's work on cellular pathology, and Julius Citron, a leading authority on serology and recognized throughout the world for his momentous work on the

Wassermann reaction as well as other important serologic problems. We must not forget to mention Rahel Hirsch working on the suprarenals, Peritz, on neurology and internal secretion, Plesch, on the circulatory system, Retzlaff, on the liver, Ohm, on the venous pulse, Ridder, in the field of gastroenterology and particularly on the œsophagus, Munk, on the kidneys and X-ray diagnosis, F. H. Levy, working experimentally on the mid-brain, Leschke, working extensively on diseases of internal secretion, infectious diseases (endocarditis lenta) and diseases of the vegetative nervous system, Arnoldi, experimenting extensively on metabolism, Walter Koch, with his detailed pathologic work on the heart, Dresel, working on the vegetative nervous system and metabolic problems, Wollheim, on the capillaries, S. G. Zondek, and his epoch making contributions regarding electrolytes, and Seelig's work on Goldschmidt's pulse resonator and his more recent work on the relationship of the parotid gland to the pancreas in diabetes.

It was characteristic of Kraus to select his assistants from the laboratory. Therefore, at the time they were chosen, Brugsch was working on metabolism, Citron on serology, Nikolai on the physiology of the circulatory system, S. G. Zondek on pharmacology, and Leschke on bacteriology. Most of these men planned to make scientific research their life work. Kraus, the great seer, noted their extreme talent, and, imbuing them with the spirit of the entire field of internal medicine, induced them to enter his clinic and correlate their work with medicine. How well he succeeded! Each today is a leading clinician!

Kraus was unusually kind and appreciative. He did not refer to his associates as assistants, he termed them his "highly honored co-workers" (*Hochverehrte Mitarbeiter*). He did not discharge an assistant. If one dropped out of the clinic, it was because he found the current of the stream too swift and strong, swirling him to the shore automatically. Those who remained any length of time with Kraus were eventually called to positions in various universities or became the heads of large hospitals in Germany, Austria and non-Germanic countries. In order to procure a position for any of his co-workers, no effort was too great for the fatherly Kraus.

Kraus cooperated in a most remarkable and effective way with his associates. This explains why he has published so

tous works in collaboration with his co-workers—*Electrocardiography* with Nikolai, *Diseases of the Œsophagus* with Ridder, *Diseases of the Suprarenals* with Rahel Hirsch, *Electrolytes* with S G Zondek, and so on. Even as late as 1927, shortly before his retirement, when Professor Goldschmidt brought the importance of his pulse resonator to Kraus's attention, Kraus worked as hard, to determine the clinical usefulness of this instrument, as did his youngest assistant, Seelig. In the winter of 1927, he experimented on the dog's heart to demonstrate the action of the various chambers of the heart kinematographically. He was able to retire from the II Medical Clinic happily, only because a place where he might continue his scientific research had been reserved for him in the Kaiser Wilhelm Institute.

* * *

Kraus, as a teacher, seemed to be less systematic than other teachers—at first. At times, the facts in his discourses seemed so disconnected that the greatest effort was required to follow him. Many who were unable to concentrate sufficiently at the start, went away disappointed, never to return, much to their loss.

If one continued the effort to concentrate, he was magnificently rewarded. Following Kraus's highly flavored scientific discussion became a pleasure, not a difficulty, as soon as one began to understand. Kraus generally extended the lecture beyond the allotted time. Two hours at a stretch was the usual occurrence, and he so interjected his lecture with philosophic reflection and original humor, that his listeners remained chained to their seats. Kraus, both as a director and a teacher may have seemed unsystematic to the superficial observer, but of him it may be said there was a system to his non-system!

Often, in the discussion of a case requiring a specific scientific explanation, he has forgotten his presence before others and has become lost in speculation over pertinent scientific problems to be investigated. Who, experiencing these hours, can ever forget Kraus? The annual three, four or five successive demonstrations on tuberculosis, or diseases of the thyroid gland, or those of the circulatory apparatus. I wish I could remember the lectures as well as I remember the teacher.

Only too well did we who listened realize the impossibility of

carrying away all that fell upon our ears, as we might from a practical clinic Yet, we were saturated to a point where, upon encountering a similar case later in practice or in the literature, what we heard would crop out

Pappenheim once remarked to me that he could not afford to miss one of Kraus's lectures on diseases of the blood because so many of Kraus's spontaneous remarks were of invaluable aid in his research Theodor Brugsch, Citron, Nikolai, Munk, Levy—practically all of the assistants—seldom missed an opportunity to listen to the lectures as attentively as the earnest students sitting on their benches On July 31, 1914, the day before the outbreak of the Great War, I happened to remark to Brugsch that I was fortunate to have heard Kraus six semesters

"Well," Brugsch returned, "I have heard him more than twenty, and I still hope to hear him" Only recently, Bela Schick, our leading pediatrician, said that even now he would not mind listening to Kraus's lectures for a number of years

Kraus lectured six mornings a week. On Monday and Wednesday, he held a clinical demonstration from 8 15 to 9 15 A M From 9 15 to 10 00 A M he held the Polyclinic To the Polyclinic an assistant from each department brought several cases for diagnosis by students with a minimum of laboratory aid in contrast to the minute method of examination of cases in the clinic proper On Tuesday, Thursday and Friday, the period from 8 15 to 10 00 A M was devoted to the clinic exclusively On Saturday, 8 30 to 10 00 A M was set aside for a presentation of the results of animal experiments bearing a direct relationship to the clinical material demonstrated during the week. It was Nikolai who carried on this work in the earlier days, and later S G Zondek, still continuing it under the directorship of von Bergmann

For many years, Kraus held a clinic every Saturday from 5 00 to 7 00 P M for the express purpose of giving practitioners an opportunity to see the important cases of the II Medical Clinic shown to students during the week. His constant plea was to keep the practical value of scientific medicine before the practitioners In order that they might see cases in which they were especially interested, he requested them to meet during the week and decide in advance upon the cases they would like to see on Saturday He yielded to

their wishes wherever possible, and during his lecture, he would look up at them often, asking, "Am I boring you? Are you interested?" Half an hour of this two hour period he discussed some scientific topic of the hour, and very often called upon the associate working upon that particular topic to address the audience

Kraus was unusually kind. When he disapproved openly of an assistant's acts—which happened sometimes—his student witnesses were embarrassed and suffered keenly at the seeming injustice of a public reprimand to a person of eminence. Those who knew Kraus—particularly the objects of his ire—understood. They were unmindful because they knew Kraus's wrath was that of a kind father.

Sometimes stern, never a flatterer, there were three traits Kraus could not endure in a student. These were lack of attention, a tendency to indulge in scientific speculation while analyzing a case, and the habit of saying, "I believe."

To the speculators, he would exclaim, "Because of your speculative wisdom, your patient will go to pieces! Too much wisdom tends to destroy!"

To those who would answer, "I believe," he retorted as spontaneously as a reflex action, "You don't know, believing is doubting! I'll have to ask the next one." He was not against a man who guessed correctly, however, and to him he would exclaim, "One must have 50 per cent to guess correctly. You have it. I love the lucky one!"

When a student showed originality of thought, he was lavish in his praise. But, often, while examining a candidate, he would be upset by the candidate's slowness, urging him to work quickly and think fast. He would quote Goethe's *Leiden des jungen Werther*—Think and act, act and think! One without the other is useless!

An angry moment, however, was always immediately followed by an apology. He would put his hand on the offended candidate's shoulder and exclaim—keen blue eyes alight with kindness and love—"Forgive me! That was only the natural reaction of a teacher. I know under what a mental strain you are working." Should a candidate, in confusion, answer incorrectly, Kraus would encourage him by saying, "Don't worry, I will ask you something you do know. I'm sure you are better informed than you imagine. I am

not here to find out what you don't know It's what you do know that reveals your intellect "

Throughout his entire career as a teacher, Kraus maintained that the primary function of a physician is to be a healer This function, he must carry out with love, and apply, with sympathy and understanding, even doubtful therapeutic measures if they were not injurious and might prove helpful The clinician who is the head of an institution, he maintained, must apply himself equally to research, teaching and healing

Kraus was universally acclaimed for his work He was consulting physician to many of the crowned heads of Europe Yet he remained democratic and tolerant, accessible to everyone who knew him or came in contact with him

My most pleasant experience, for which I take this occasion to express my deepest gratitude, was when Dr A. A. Goldbloom and I approached him on the topic of an American Scientific Institute He responded to the plan of international postgraduate medical education in a most liberal manner, laying out a plan, with Brugsch, by which the United States, Germany and other countries' might exchange facilities for postgraduate work He felt that the establishment of such a plan would be a great advance in medicine, and by his influence, the highest government officials in Germany endorsed and promised support to the cause Men in the commercial world, as well as members of the American Chamber of Commerce in Berlin and the American Institute of Education, were led, through Kraus, to contribute morally and financially Men like Aschoff, Umber, Walter Koch and Fr v Muller approved because they hoped the plan would bear fruit which would rebound to the credit of the two—Kraus and Brugsch—who so stimulated the undertaking that they deserve the title " Medical Ambassadors to Foreign Countries " This plan is in vogue today in the New York Academy of Medicine through the good work of the President, Dr Samuel M Lambert, Col F P Reynolds, Dr Linsley R Williams, and Dr Samuel J Kopetsky, Chairman of the Committee of International Medical Relations It is hoped that it will be adopted in many medical centres

In March, 1927, because of the age limit, Kraus retired from active teaching He was admired to an unusual degree not only by

men in his own profession, but by hundreds from many other walks of life, and when he delivered his farewell address there were tears in the eyes of his associates and all who had worked with him.

His *Allgemeine und Spezielle Pathologie der Person* and his *Tiefe Person* have registered his scientific influence upon the world. In order that his personal influence might be preserved, inspiring the world at large and the medical world in particular, all who have worked with him are now banded together in a philosophic society known as the *Krausia*.

On the completion of his seventieth year, it is our ardent wish that Friedrich Kraus, the famous clinician, the kind chief, the splendid teacher, and the most loved of men, shall continue for many years in as excellent physical and mental health as that he enjoys at present.

Medical Questionnaires

What is the present conception of colds?—Damp, chill inspired air has a relation to the oxygen absorbed for assimilation of food, and for the protection of the body from infection. If the child is exposed to raw temperatures and dust the natural epithelial covering, which is a defense for the respiratory tract, may be damaged. Persons become accustomed to deficient breathing and the case becomes more and more chronic, and where there is a tendency to adenoids, the case may be worse. The ears, throat, and nasal cavities all enter into this exposure. Breathing, having become impaired, causes charging of the system with carbonic acid and autointoxication results. The consequence is a diminution of the natural resistance, and many fall prey to tuberculosis and other infections. Catarrhs change and destroy parts of the epithelial lining, and germs invade it and the adjacent lymph glands. Habitual respiratory insufficiency in children causes incomplete development of the skeleton, thoracic muscles, and apical collapse may be the consequence. Alfaro warns that children with colds should be isolated. The body temperature must constantly be kept at an optimum of 37°C which must be provided by the body. If the body is not kept at this temperature as in some of the cold-blooded animals, there is partial cessation of life's activities for parts of the year in temperate and cold zones of the globe. This is not the case in man, and therefore the upkeep of the temperature constitutes one of the greatest physiologic energies. Each living being is a machine subsisting on certain economic energy, but the warm-blooded animals do not produce a great effect, for what is expended. Production of warmth has been considered a mere by-product of metabolism by most physiologists so far. Strecker is inclined to consider warmth a physical force of strength for all vital functions. The complex climatic and cosmic conditions, such as changes of light, moisture and temperatures, and air pressure, weight of body, all enter into the production of warmth. All are balanced by the constancy of production of energy. There is physical and chemical regulation. Colds do not only constitute a cooling of the body surface, but there is a certain general reaction or a predisposi-

tion of the body A number of diseases are produced by more or less marked chilling of the body surface and not all colds are abortive They do not form a uniform group of diseases, and each of them may be produced without chilling by infection, chemicals, metabolic disturbances Frost-bite, though caused by chilling, is not to be compared for there are lesions Predisposition for frost-bite and colds are not the same The degree of cold is not essential and weather does not explain this condition The cooling of the body is the cause of colds in low temperatures, or following a sudden drop or strong evaporation of the skin The cutaneous capacity for regulation is great The reaction of the cutaneous vasomotors protects the inner temperature State of nutrition, immunization conditions of the body, defects of the organs, presence of certain disease agents are decisive for the type of cold which develops The point where the low temperature strikes is not determining for the type Often muscular rheumatism and neuralgia develop where there is a predisposition of the organs for it, alcohol and traumatism enter into this type Articular and renal diseases, though they are aggravated by cold, are not definitely referable to chilling It has been found that dipping of the hands or feet in cold water produces transient albuminuria It seems that bladder and intestines are subject to functional disturbance when chilled It may be that cold gives the saprophytes of infection a chance Loew found the complement content of serum subject to regular fluctuations, more so in summer, and decreasing towards winter, and lowest at the end of February or the beginning of March This corroborates Lederer's curves, with the lowest point of complement content coinciding with the peak of diseases Most striking is the recurrence of chronic infectious diseases, such as measles, when the lowest point of complement content is reached Hess and Lundagen found parallel curves for phosphor content Probably there is a parallel to the length of insolation (violet rays) Alfaro commends the use of polyvalent and mixed vaccines with antipneumococci, antigrippe, antipertussis, antipyogene constituents, and giving antigen in form of proteins, colloids, etc Children especially, but also adults, suffering from colds should be isolated Preventive measures are most important Rinsing of the mouth, nose and throat should be routine procedures of everyday baths Ventilation is most essential Discarding of handkerchiefs

should be generally adopted, and the Japanese habit of paper handkerchiefs, especially while patients are suffering from colds, should be a matter of course

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What produces the birth act?—It is difficult to forecast accurately the uterine powers. Abnormal uterine action may show itself in primary uterine inertia or exhaustion, or tonic contraction of the uterus. There may be premature uterine retraction, precipitate or painless labor. The latter is due to diseases of the spinal cord in most instances. The three layers of muscle fibres of the uterus are distinguishable only during pregnancy. The Mullerian ducts, or the tubes derived from them, and the uterine ligaments, determine the direction of the muscle bundles. The powerful middle layer has circular fibres. Gibson states that the uterus seems to form part of the vascular system, and it follows vasomotor impulses, subject to ergot, pituitrin, and nervous shock. There is a rich supply of fibres from the sympathetic and cerebrospinal systems. Solar, renal, and genital ganglia, form a plexus above the sacrum. Contractions of the round ligaments synchronize with the uterus and moor it in the pelvis during labor. The uterosacral ligaments maintain the axis in position during uterine contractions. The round ligaments pull it forward and draw the axis in a line with the axis of the inlet. Both autonomic and sympathetic stimuli are controlled by the higher centres in the medulla, and possibly the cortex. They are probably important factors in normal uterine contractions. To be effective contractions depend equally upon the integrity and correctly adjusted balance of autonomic and sympathetic impulses. Expulsion of the child at term is not due to sudden labor pain-producing influences coming from without, but to mechanical func-

tion of this organ, which becomes gradually more potent, and at last expels the child. At Cambridge, Knaus with Marshall, found that it was not possible to produce abortion in pregnant rabbits up to the 18th day by pituitrin, not even with high doses. This was explained by the uterus not having reached a sufficient degree of contractility. This latter assumption proved incorrect in later studies, for the uterine muscles failed to contract and they did not react to hypophyseal extract. They did, however, react after 18 days. Heap was the first to point out that generative processes in the rabbit, in contradistinction to most mammals, has no periodic ovarian cycle, and that there is no spontaneous ovulation, but that the latter is dependent on strong sex stimuli. Ancel and Bouren showed that 9 to 10 hours after sex contact a pseudopregnancy is produced if the ovarian cell leaves the ovary, and has not been fertilized. The ovarian cell then dies after a few hours. The development of the corpus luteum lasts on an average 18 days, then all signs of pregnancy disappear. During these first 18 days rabbits build nests. The average rabbit pregnancy lasts 32 days. Knaus' experience with pituitrin in animals in pseudopregnancy points to influence of autogenous corpora lutea. When they could be demonstrated in the ovaries of the rabbits there was no response to pituitrin. There is then a distinct antagonism between the corpus luteum and the posterior lobe of the hypophysis as related to the uterine muscles. As long as corpora lutea secrete the uterine muscles have no capacity of responding to the hormonal stimulus of hypophyseal secretion. The uterine muscles become flaccid and are at rest. The experiments, furthermore, showed that the corpus luteum causes increase of blood supply and swelling of the uterus, with proliferation of the mucous membrane and the milk glands, that it hinders further ovulation but not the growth of uterine muscular cells characteristic of pregnancy. Birth is dependent on increasing contractility of the uterine muscles, the autonomous powers of movement, and tonus, and regression of the corpus luteum with the liberty for the hormones to act on the posterior hypophyseal lobe. Not the hormones of the ovaries or the corpora lutea cause growth of the cells of the uterine muscles during pregnancy, but the egg itself.

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What are some of the newer conceptions on infant feeding?—Milk in artificial feeding of the new born is often too much diluted. This practice was adopted at a time when the milk supply was of doubtful quality. Up to the second month more than 50 per cent dilution is unnecessary. Water or soup with 5 to 8 per cent sugar should be added. During the second to fourth month two-thirds milk may be given. In the fourth month vitamins in form of fruit juice are added. In the sixth month, cream of wheat, quickly cooked oats, sago, tapioca, soup and vegetables. At the close of the second month the amount of food given should be 900 to 1,000 gm. During the first year the child should not have more than 1,000 liquid, especially where the child is of an exudative diathesis. Most children after the second month can be given either of the above diets, though some children become constipated from higher concentration of milk, and get clayey, foul smelling, fatty, soft faeces. The abdomen becomes bloated, and weight increases slowly. These children often do well on flour. Another group becomes dyspeptic on flour, the children have diarrhoea, vomit, and lose weight. These constitutional groups must be kept in mind, and treated individually. Where reactions to constitutionally faulty diet occur it is an error to give laxatives. Give the stomach a rest in the form of a greater dilution of milk for a few days, and adopt another method. Lederer does not advise vegetable and soup during the fourth month, although 20 to 30 per cent of children may tolerate it, others have severe digestive disturbances. Where there is danger of lack of vitamins, vegetable juices may be given without the cellulose. Calomel and other local cleansers of the intestines, in digestive disturbances are now used almost exclusively in severe infections, that is in diarrhoea with high temperatures. Generally a tea diet for from 12 to 24 hours suffices. In febrile dyspepsia albumin milk with 4 to 6 per cent sugar for required carbohydrates may be given. Diarrhoea has recently been recognized as due to exogenous influences only in exceptional cases.

Generally it is due to endogenous invasion of intestinal bacteria to which the intestine responds with increased motor and secretory activity. Under normal conditions the intestinal bacteria balance each other's function. Children may have diarrhoea even if milk has been collected sterile. The components of the food may not be suitable in quantity and quality for the tolerance of the child. Supposing the child has a definite capacity for albumin or other food stuffs, and is given too much, the balance of the intestinal bacteria may be upset. Moro found that the upper duodenal section normally contained few bacteria or none at all, but that during diarrhoea it contains many coli bacilli. They were not encountered in normal infants. *Bacillus bifidus*, a normal inhabitant of the breast-fed infant, thrives in acid medium, while *bacterium coli* develops in alkaline or weakly acid media. The reaction may be changed by diet, rich in carbohydrates and scant in albumin, which produces an acid reaction, while much albumin, that is milk, produces an alkaline reaction. The stools of artificially fed infants are mainly alkaline, of the breast-fed, acid. Calomel helps discard from the intestine products of decomposition, but an anti-bacterial effect is not produced by it. Intestinal disinfectants hit the pathologic and physiologic bacteria simultaneously. The generally adopted diet of tea at the onset of diarrhoea retards endogenous invasion, however, too long continued fasting has some bad effects, such as loss of fluid, includes danger of acidosis and loss of strength. It is necessary to stop the sudden drop in weight. Woman's milk is not capable of doing this, as it contains little salt, and it has not enough nitrogen and too much fat for the sick child to digest. Possibly one might correct this by extracting the fat from it. The fundamentals of artificially fed infant diarrhoea are to stop drop of weight brought on by the intestinal discharge and increased perspiration, to give water and salts, and sufficient calories to protect the child from dehydration, hunger and endogenous invasion. Sugar diet is cheap, abundant and palatable. It is readily soluble and converted into heat and energy in the body. With much white flour, commercial breakfast foods, white potatoes, margarine butter, meats and coffee, there is a great lack of vitamins. This is the most serious dietetic error committed in feeding children, especially in the United States, where the per capita consumption of sugar has increased 500 per cent. in

the last 50 years, every person taking a tea cup full of sugar per day. The child pampered with sugar will not drink enough milk, or eat enough eggs, fruit or vegetables to provide fats, proteins, minerals and vitamins. It often becomes rachitic, prone to colitis, and infections. It becomes pale, weak, undernourished, or fat, flabby, indolent, self-indulgent during adolescence, and a dyspeptic, diabetic, obese adult with cardiac and renal diseases. It is especially the child with exudative diathesis which suffers from sugar intolerance.

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What branch of science has recently been drawn into the scope of the medical sciences?—Graphology, which was employed by some psychiatrists for many years in the diagnosis of mental diseases, and more especially general paralysis, and which has been quite a study at the Munich Institute of Geheimrat Kraepelin, has now been drawn into the activities of medical societies. A special session was devoted to it at a medical meeting last year. In 1928, geographic pathology has been organized by an international society which is studying the questions entering into geographical location and the changes in the body. Pathologists, anatomists, physiologists, hygienists, clinicians and chemists have participated in the discussion. Man and animal alike were put on the program.

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What is the present opinion on ozæna?—Ozæna, according to consensus of rhinological science, is a disease of the nasal mucous membrane, which probably develops in young years, and is due to a number of varying constitutional and environmental factors. Serum treatment, as a partial therapy, has yielded good results, but

must be supplemented by a number of mild local applications, and if all fail, but not too late, operation is indicated. Though rare, it is sometimes inherited. The geographic distribution so far seems unexplained. Ozena has been found frequently in eastern and not in western Germany, it is frequent in Constantinople, Spain, China, Japan and Greece. Occupation seems to have an influence, for ozena is encountered often among cobblers, saddle makers, and washer women, especially when undernourished. In Constantinople it is found mainly among the delicate Greeks, Turks and Armenians are not so frequently affected. The skull types more commonly involved are the short heads with flat noses, short septum, and broad palate. Ozena is rarely associated with adenoids, for the latter are found more frequently in long heads with long noses. The disease is often associated with tuberculosis, scrofulosis, syphilis, and lymphatism. Fleischmann found hypocholesterinemia. Endocrine disturbances reduce cell and tissue resistance and increase of bacterial inflammation with ultimate involvement of the nasal mucous membrane.

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What are the newest results of studies on Brucella melitensis infection?—In recent years increasing numbers of cases of *Brucella melitensis* infection reported in the United States indicate a more common recognition of this disease. The first was described in 1906 by Craig. It has been endemic in the southwest, where goat raising is an important industry. It was epidemic in Arizona in 1922. The first human case in America was reported by Keefer in 1924. Evans collected 21 bovine infections in 1927. *Brucella melitensis* infection is characterized by waves of fever alternating with absence of fever, evening peaks and morning remissions, chills, sweats, anorexia, loss of weight, pains and even swelling of the joints, enlargement of liver and spleen in some instances. Evans showed the relationship between *Brucella melitensis* of goats and *Brucella abortus* occurring chiefly in cattle and hogs. It seems that the goat strain is more virulent for man than the bovine. Some of the cases reported showed the undulant type, and others the clinical picture of severe Malta

fever Kern states that there is as yet a very low index of clinical suspicion of the presence of the disease among general practitioners In Denmark the Widal test is made on cattle and *Bacillus abortus melitensis* has been isolated and described A vaccine has been attempted and mercurochrome has been used quite extensively The main improvement in arresting the spread of this disease is seen from supervision of cattle, and personal individual caution, using pasteurized milk, avoiding raw milk, and the cooperation of intelligent dairymen should be solicited Segregation of cattle infected with the disease will be necessary

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What are the problems of preventive medicine?—The average length of life is now 55 years in countries where people live under advanced sanitary conditions In India it is still 25 years, which it was in America not more than 25 or 30 years ago Modern preventive medicine basing on scientific advancements, especially Pasteur's bacteriology now about 60 years old, has wrought the change Childhood mainly has been benefited Old age has not yet been brought under the control of prevention. Yellow fever, cholera, bubonic plague, infantile diseases, malaria, and smallpox have been mastered, though not all people have been convinced, nor can they be induced to follow preventive examples—Among the unsolved problems are influenza, cancer, diabetes and heart disease The present scientific knowledge, if better utilized, will constitute the progress in prevention of disability Physicians should be advisors, and should know more about hygiene, and stress it An interrelation of the activities of physician and health officer must be aimed at

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What has been gained from studies of the recent dengue epidemics?—Burg refers to 103 names for dengue. According to Roux, the first mention goes back to Strabo. In 1761 and 1767 epidemics were reported from Cadiz and Seville. David Bylon describes an epidemic of Batavia in 1779 as "Knokkelkoorts." In Asia, Africa and America larger epidemics have been seen. It is prevalent in hot humid places, but elevation does not seem to play a part. It was found at altitudes of from 12,000 to 15,000 meters in the Libanon mountains and India. Most writers are of the opinion that the pathologic agent has not yet been described.—In 1926 dengue was pandemic in Tripoli and the Athens epidemic in the fall of 1927 has been quite severe and led to extensive investigations. The disease may be transmitted by water or by land, and the extent of spread has amounted to as much as 50 per cent of population in 1926, according to Mazzolanı. At the close of September, 1926, the epidemic started and was under control by December. Many physicians at first thought it was benign influenza.—The brief duration of the disease and the short time of incubation necessitates many human passages. At Athens experiments were made in winter and spring before *Stegomyia* appeared or the disease had reappeared. Experimental dengue is of classic clinical type, but it may be reduced to a slight fever, and may not become manifest. Ashburn and Craig, in the Philippines, showed that inoculation of blood of patients into healthy men produced infection.—In the first 2 or 3 days the virus seems most powerful. The blood, during the later days, inoculated into 5 persons had no results. The blood of patients up to the third day was infectious, as was proven previously by mosquito bites. Later experiments showed that weak virus, though not producing high fever and eruption, produced a mute infection. It is found several days after injection. Repeated human passages did not seem to increase the virulence.—If kept in the dark, and well sealed, at 15° to 18° C the virulence of dengue patient's serum preserved its virulence for 54 days. Mute infection makes man immune, but his blood remains virulent. A spirochete which had previously been considered the pathologic agent was not found in the blood and urine by Conseil and Durand in the Tunis epidemic of 1927. *Culex fatigans* has been considered the carrier, but also *Stegomyia calopus*, and *Phlebotomus pappatasi*.—During the first

few days the patient has a temperature of 39° to 40.5° C, then sweats profusely. The pulse is slower than would be expected with the fever, but may gain 110 to 120 beats. Some patients develop respiratory crises, but there is no catarrh. Often the gastric reaction is early and violent, even after the intake of small amounts of fluid similar to the vomiting of pregnancy. Joints and muscles are painful, especially the dorsolumbar, also the ribs, and sometimes the nape of the neck, and the region above the knees. Patients are excited and often melancholy, have insomnia and headache with throbbing eyeballs.

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How far have d'Herelle's bacteriophage theories been applied to therapy?—Bacteriophagy of d'Herelle is in the stage of therapeutic experimentation. In putting into practice it is necessary to choose microbic species which have homogenic characteristics with the bacteriophage. A strain of bacteriophage virulent for a specimen of these germs will be so for all. There are dysentery bacilli and pest bacilli in human pathology from which veritable stock bacteriophages may be prepared and which can be used for treatment of these diseases, without trying the filtrate in vitro each time—Coli bacilli and paracoli are very active for certain specimens, but not for others. In every instance the activity of the bacteriophage kept at the laboratory has to be tried on the organism isolated from the patient who is to be treated. The virulence of the lytic filtrate often can be increased by several passages. Different strains of staphylococci can be employed as stock bacteriophages but coli bacilli and typhoid bacilli have failed. However, there may be bacteriophage strains, capable of destroying them. Forms of the different bacteria seem to change in symbiosis with the bacteriophage, especially in chronic cases. Grenet and Isaac-Georges give bacteriophage in massive doses, 10 to 20 cc, by mouth, and simultaneously 2 cc under the

skin for typhoid.—In urinary infection 10 to 20 c.c. are injected into the bladder For staphylococcus 1 to 2 c.c. under the skin, and local compresses saturated with bacteriophage are used They are repeated twice or three times in 2-day intervals Improvement should appear within a few days Only 1 of 7 cases of typhoid were satisfactory In urinary and coli bacillus infections, good influence was seen in most cases, but bacterial and clinical cures were rare For furunculosis the treatment deserves to be generalized

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CONSTIPATION

A RÉSUMÉ OF THE LITERATURE AND THE OUTLINE OF A RÉGIME

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ACCORDING to Professor Summer, the first two kinds of medicine were emetics and cathartics, and for some time they constituted the two great branches of the healing art

The first conception of man regarding disease was that it was produced by evil spirits who had taken possession of the diseased body This idea of spirits causing disease was carried well over into Christendom and led naturally to a system of therapy directed at the avoidance or expulsion of the intruding devil To do this it was necessary to make the usurped abode of the disease-producing demon as unpleasant as possible To this end the patient was beaten, starved, drenched with every foul concoction that could be imagined by the savage mind In addition the patient was smoked with evil-smelling substances, his body was pounded and kneaded, and frequently suction was used to extract the evil spirit Thence has come our medical technic The sacrificial letting of blood became venesection, suction became cupping, the kneading was rationalized into chiropractic and osteopathic manipulation and into true massage Medicines, as recently as the Middle Ages, were selected for the purpose of expelling the evil spirits With these, of course, unpleasant appearances, odors and taste were therefore a virtue This accounts for the deep-seated superstition in the minds of all of us that the efficacy of the medicine we take is in direct proportion to its nastiness

While from the blundering adventures of the tribal medicine man we have been given some of our greatest remedies, such as quinine, opium and mercury, space does not permit us to go into detail about the history of our present-day cathartics Many of them did come to us from the same sources Castor oil is known to have been

Cole dye test of the gall-bladder function, for often the gall-bladders of these patients do not visualize. Certain diseases of the heart and liver produce portal engorgement, thereby leading to lessened peristalsis. Acute febrile diseases and diabetes mellitus dehydrate the body and, as a consequence, there is over-absorption of water from the fecal residue and retarded peristalsis. Tumors of the gastro-intestinal tract or adjacent organs may produce stasis or partial obstruction. The origin of the trouble may be a chronic appendicitis, pseudo-appendicitis, cholecystitis, diverticulitis, leal regurgitation, flagellate infection, hæmorrhoids, *et al*. It should be understood, however, that the constipation associated with most of these conditions is not so much an actual constipation as it is a loss of appetite with reduced food and liquid intake, and a consequent reduction in the volume and consistency of the fecal mass.

In the chronic invalids (Bryant) about whom we have spoken to you so much and so frequently, conditions are ideal for the development of just such a situation. An irritable nervous system breaks down readily under the strain of working, the appetite becomes dulled, the food intake is reduced, and a mild anæmia develops, along with a state of sub-nutrition. There are hypersensitive zones in the sigmoid, descending colon, splenic flexure, transverse colon, or at times the entire colon and rarely the small intestines that may be compared to the so-called "neuritic points" in the spine, joints, and other bony prominences of this type of individual. Visceroptosis adds to the difficulties to be overcome, and periodic spells of headache suggest to the patient that she is absorbing poisons from her intestinal tract due to constipation.

The promiscuous, ill-advised use of cathartics in the treatment of respiratory infections has no common-sense basis and only decreases the patient's resistance for fighting the infection. Dr Hugh McDonald has given us some very interesting figures showing the ill-effects of cathartics in the treatment of "common colds." In this connection we will do well to remember a paragraph from "Currents and Counter Currents" in *Medicine* written by Oliver Wendell Holmes sixty-six years ago: "If it were known that a prize-fighter were to have a drastic purgative administered two or three days before a contest, no one will question that it would affect the betting on his side unfavorably. If this be true of a powerful man

in perfect health, how much more true must it be of the sick man battling for life "

Constipation, like other abnormal states in the body, may be either *organic* or *functional* in nature. Physicians usually refer to the organic type as OBSTIPATION. This is by far the less-frequent in its occurrence. Since its treatment is usually surgical, we shall not consider it further than to emphasize the importance of its differentiation from true constipation.

If you give a moment's thought to this classification of the kinds and causes of delayed bowel movement, you will appreciate that the first step in the treatment of constipation is a careful study of each individual case.

Having condemned as severely as we know how the thoughtlessly or routinely administered cathartics to the patient with constitutional disease and organic pathology affecting the gastro-intestinal tract, we shall deal from here on in what is the body of this paper with functional constipation. These cases make up the great bulk of a physician's practice.

The researches of Rosenheim, Holzknecht, Case, Mills, Cannon, Hurst, Soper and W. H. Mayo, and Alvarez have enabled us to place the discussion of chronic constipation on a rational basis. The recto-sigmoid performs an important function in regulating the time of the act of defecation. It appears that this apparatus holds up the column of feces and prevents it from entering the rectum until the proper time for defecation has arrived. At this time the muscle fibres relax and permit fecal matter to enter the rectum. The weight of the feces excite the "muscle-sense reflex," causing expulsion of the rectal contents. This procedure is repeated until, as Hurst has shown, the normal adult doing active muscular work will completely empty the colon from the splenic flexure to the anus.

It must be emphasized that all other times the rectum is free from fecal matter. Under normal conditions but one such passage should occur daily. On the average, after the act of defecation it requires twenty-four hours' time for the fecal column to reach the recto-pelvic junction. About thirty-three hours' time is required for a meal to be entirely evacuated from the gastro-intestinal tract. Food taken nine hours before the act of defecation should reach the splenic flexure and part of it appear in the feces. These figures

taken from Hurst represent the time required for the average healthy individual at active muscular work. Modification must be made for asthenic type, who habitually have a slower rate of alimentary motility as well as the hyperasthenic type, whose motility is higher than the average normal (Soper)

ETIOLOGY

As a cause of constipation the cathartic habit easily takes first place. Fully 85 per cent of cases of functional constipation have this as their cause.

The enema is nearly as bad an offender as the cathartic. It washes away normal secretions and introduces a foreign substance to irritate an already-irritated bowel. Even its mental effects are bad. In addition to serving as a mental crutch to all of its victims and the *fixing of wrong conception of colonic physiology in many*, it affords a vicarious sex gratification that while pleasing to the patient is not good for either his body or his soul. Then comes another great cause of constipation, namely, the indiscriminate use of bran and other irritating foods. Vaunted by health lectures and magazines, advertised by commercial food concerns and many times advised by the doctor as well, it continues to be put into an already irritated bowel where its irritation, although producing bowel movement for a while, only serves to deepen and increase the inflammation which is the basis of the patient's malady.

In no place that I know of in medicine must a history be so carefully taken as in the study of the patient who complains of constipation. Usually when asked why he thinks that he is constipated he will say that his bowels won't move or the movements are too small, unless helped by a laxative, and yet he is not able to tell how large a normal daily movement should be. On closer inquiry it is then found he does not give his bowels a chance to function normally. Ask him to describe his stool and he will say that it is mushy part of the time or small and flat or pencil-shaped, or small and hard balls. More or less mucus may be observed and perhaps at times a *stool of pure mucus*. Even nurses and internes are apt to refer to the normal stool as a constipated stool. The feces should be firm and consist of small masses welded together into a collected form.

I believe that I can best set forth my ideas on the management

of functional constipation by giving you the instructions which I gave my patients

THE DAILY RÉGIME

Every effort should be made to get a good night's rest. This outline begins in the early hours of the morning because this is the most convenient time for the starting point, and because normally during the night the slow movement of the intestines has brought to the rectum all of the waste products and residue of the food. This movement of the fecal mass into position constitutes in itself *the first stimulus to defecation*.

The act of waking, itself, constitutes *the second stimulus to defecation*. Immediately upon waking the mind should be concentrated upon the act. It is surprising how very largely intestinal evacuation is a matter of the right mental attitude. There are very few people indeed so constituted by nature, as not to have regular movements if they form the right habits. Above all, it is important that the anxious solicitation which a great many people have and foster sedulously with regard to the effect of even slight disturbances of the intestinal function should be overcome. If the normal habit has been lost through carelessness or addiction to the laxative habit, it must be reestablished by visiting the toilet at a regular time each day—"not to read the newspaper but to move the bowels". The will is needed for intestinal function, to regulate the diet, to increase the quantity of fluid, to secure regular habits, and most of all to eliminate worry and anxiety which interfere with intestinal activity. This concentration of the mind upon a determined effort—if possible, to have a bowel movement, but, if not, remember that tomorrow is another day. form *the third stimulus to defecation*.

The fourth stimulus will be a glass of water, taken as soon as one is out of bed. Cold water passes promptly through the empty stomach and stimulates the intestines to active movement. The water itself is good, but its value can be greatly enhanced if the juice of a lemon or an orange is added and taken without sugar. Most people drink too little water. A most excellent rule to follow is one glass of water every two hours during the day while awake. This gives a minimum of eight glasses. Even more in hot weather

Avoid ice water if possible. If nothing but ice water is available, sip it slowly so that the stomach will not be chilled.

Exercise is to be utilized as *the fifth stimulus* to defecation. In addition to the acts of waking, getting up and the movement of the body caused by the toilet, it is essential to make use of definite gymnastics which have as their object the strengthening of certain groups of muscles which are essential to handling normal bowel movements. The exercises to be followed are

Exercise One—Position You are to lie face down, legs extended, with arms straight beside the body or with hands upon the buttocks, so that the arms are not in position to assist the back muscles.

Method—With the head straight, resting on chin, you attempt to raise head and back slowly and see how much of the ceiling you can see. After this, sink slowly to original position, head and back must not rotate sideways. Between each attempt there must be complete muscular relaxation with one or two slow, full inspirations and expirations.

Exercise Two—Position Rest flat on the back to avoid collapse from the unaccustomed hypernea and to avoid lifting the extra weight of the arms and shoulder girdle during respiration.

Method—Without inspiration, see how far down you can "spring" the lower ribs. Breathe *entirely* with the diaphragm and abdominal muscles. Do this slowly, not using the chest at all for breathing. Now practice this until you with less and less effort get all the breath you can use in this manner. Keep the mouth open during the exercise. Finish by making the abdominal movements a little more violent though not faster, so that you actually hear the shaking of your insides.

Exercise Three—Position Recline flat on the back in perfectly straight line, with right hand resting across the abdomen so that the middle finger tip is just within the crest of the left hip bone, left hand along left side.

Method—Now raise the head a little, move the body to the left, extending the left hand along the side toward the left ankle, *as far as possible*. Go through this slowly and return slowly to the resting position. Between each full movement relaxation and respiration are required.

Exercise Four—Position As in three.

Method—With the hand upon the abdomen above the navel, raise the head and shoulders several inches toward the sitting position until the firm contraction of the muscle is felt with the hand, then sink slowly back to reclining position.

There are three suggestions which should be followed.

1 SLOW (Rate of movement should never exceed five seconds per linear foot and better ten at first) Firm, controlled action is imperative.

2 TAKE IT EASY Do not attempt too much at first. Your guide and ideal should be to stop short of fatigue and breathlessness.

3 DO IT REGULARLY Let no morning or evening go by without your regular seance.

It is easy at first to slip a seance occasionally, on one pretext or another. Nothing should prevent the doing of these exercises for the first month. After that the habit will have been acquired and will mean as much as brushing the teeth or dressing the hair. These exercises are to be taken with as little clothing on as possible, with a window open no matter how cold the weather gets. As better development and endurance, better metabolism, are acquired, the exercises can be done a greater number of times. As something to work for, five performances may be added to each one each week. It is important always to do them accurately and not to deceive oneself by pretending to exercise. In a few weeks these exercises give a distinct pleasure and stimulation. The feeling of brain fag, disinterestedness, dulness and fatigue to the point of feeling utterly unfit to attempt the exercise on a given evening will be dispelled by making the beginning. Then, too, there is an exceedingly gratifying sensation which comes from having lived up to one's schedule. Fifteen minutes a day spent at these exercises will bring ample reward for the effort spent.

According to Berthe, the ancient Chinese exposed the abdomen to cold air in the treatment of constipation. Cold applied to any part of the skin, but particularly to the abdomen, appears to stimulate reflexly the muscular coat of the entire alimentary canal. Heat, on the other hand, has the opposite effect when applied to the abdomen, as shown by the relief it affords in colic due to over-activity of the intestinal contraction. Hence a cold bath taken every morning should form *the sixth stimulus to defecation*. It is most effective when combined with exercise in the form of swimming. For the most of us, it is not possible to effect this happy combination as a part of our daily routine, as bathing and exercise must be taken separately. Cold plunges of course are for the robust. If you are one of these who cannot tolerate a cold bath and who suffer from chronic atonic constipation owing to deficient activity of the intestinal musculature, then you should sponge your abdomen with cold water.

The placing of food in the empty stomach will now give you the *seventh stimulus to defecation*. Your breakfast should be hearty. Therefore there are a wide range of things you can select. You are

to remember that the foods themselves are not costive, but some supply little residue and others much

The present-day diet is as often planned to suit the mechanical needs of the kitchenette and the working hours as it is by good sense. A common breakfast often consists of orange juice with the residue carefully removed, egg which is almost completely digested and absorbed, white bread, roll (often toast) residue has been removed, coffee with no residue

This menu is typical of the modern diet, yet with almost no residue at all in the meal the age-old superstition demands a large bowel movement. It would be much better for you if you will use an "unrobbed" cereal for your breakfast. Eat whole wheat, yellow cornmeal, oatmeal, or any cereal that contains all of its natural elements in their natural proportions

Prepared cereals are cooked either wholly or in part by dry heat during the process of manufacturing. The action of the dry heat on starch changes it to a more soluble form of carbohydrate, dextrine. The Iowa and Maine Station investigations, however, show that the amount of starch so digested is but a small percentage of the whole. As a rule some form of malt is added, while the malt also helps to digest some of the starch, it is the characteristic taste that is the pleasing and valuable feature.

In addition to the pleasing malt tastes, these prepared foods have certain esthetic values which are highly beneficial. Particularly in hot weather these cereals look less heavy and for that reason may be more appetizing than the home-cooked cereals.

Ready-to-eat cereals cost more than those that require cooking, but in comparison with other carbohydrate foods, such as vegetables and fruits, all cereals are inexpensive. The prepared foods retail as high as sixty-eight cents per pound by the package. The form is therefore a luxury, for in no sense do you get your dollar's worth. The housewife by grinding her own wheat in an ordinary coffee mill can prepare a good cereal breakfast food for three or four cents per pound. The preparation of this food is simple and inexpensive if it is brought to a boil and put in a fireless cooker overnight.

On the whole, eat the foods that originally gave the human race its physical vigor, and you will get all the vitamins, the sunshine and the fresh air that the food has absorbed during the days of its growth.

Fruits are also an important item for your breakfast. Oranges and apples are best eaten skins and all but apples are more apt to be eaten. Other fruits, too, are good—cherries, grapes, apricots, peaches, prunes, and figs. A sensible breakfast should include an “unrobbed” cereal, whole-wheat bread, fruit, adding anything else you need to complete your meal.

You have now received seven distinct stimuli to defecation, any one of which would be adequate in a normal, healthy person. This will all have been in vain if you neglect the hygiene of the bowels. This is the time when you should make an attempt every day to open the bowels. After breakfast the contents of the alimentary canal are collected in the lower part of the large bowel (the pelvic colon), the seven stimuli to intestinal activity have propelled some of the contents from here into the rectum, where they give rise to the call to defecation. Form the habit of going to the stool at a regular definite hour each morning. This is of the greatest importance. In little children, even from very early years, such a habit can be established. A little patience is needed, though there should be no forcing and after a time a very satisfactory habit can be established in this way.

Constipated people can be divided into two large groups according to their mental reaction while making this attempt. Those who give too little time and thought to the matter and those who are too anxious and thoughtful. As a rule, at first, a voluntary effort is required to invite the desired reflex, all of the individual's attention is required for this. Once the reflex is set in motion, it is best completed when left to itself and not hurried. Reading, smoking or both is beneficial during this stage, for further attention to this act is more apt to result in inhibition than not. It is rare that a single effort is sufficient to completely evacuate the fecal accumulation. So that the attempt should not be hurried but more than one attempt made after a few minutes have elapsed. Much can be said about the highest of closets, but this would have but little practical value as most of us are compelled to use the standard seat introduced with modern plumbing. This is faulty in construction. Allow us to say in passing that children be provided with receptacles upon which they can squat in the normal fashion and never be left with the leg dangling during defecation. Persons with

abdominal muscles or persons suffering from dyschezia (that condition in which there is no delay in the arrival of the feces in the pelvic colon but their final evacuation is not adequately performed) should use as low a seat as possible. A wooden foot stool nine inches lower than the seat should be used when the seat is too high. In severe cases it is best not to sit at all but to get the benefit of all reserve power by squatting over a bed pan on the floor.

There are unfortunately many individuals who think that their fecal output should be of a certain average daily quantity, and when careful scrutiny reveals only a small stool they at once seek to produce a large one by aperients or other means. These persons should follow the advice of Goodhart: "Do as dogs do, never look behind you", then there will be 182 days in the year on which they pass a big stool and think they have passed a small one and 183 days in which they pass a small stool and think they have passed a big one. It is to be remembered that it is not necessarily abnormal to open the bowel on alternate days or even less frequently. As has been said, fear and dread must be disposed of by realization that a cure can be effected if only the patient wishes it. Such conditions take years to develop and sometimes at the beginning of the new régime progress is made slowly. *But it is made.* As you go about your daily work, do not forget your hourly glass of water. Several times through the day, stop for a few seconds and take a few very deep breaths. Ordinarily, breathing should be unconscious, but every day deep breathing exercises should be employed. Sometimes during the day when you find yourself out of doors, take a dozen or two deep breaths, using every available inch of lung space which you have. The exercises should be deep, slow, rhythmic and through the nose, not through the mouth. Get a hundred deep breaths every day. For the rest of the time, assume the definitely erect posture. Breathe properly so as to get plenty of oxygen. A lack of oxygen means a lowered metabolism, a lack of "pep," and is the basis of a vast amount of ill-health. Get plenty of oxygen by placing yourself where it is and by using it.

In selecting the diet for the two remaining meals of the day, the person suffering from chronic constipation must come to an appreciation of the great importance of a rather strict adherence to a few fundamental principles. A strict adherence to these will in itself

cure most cases of constipation and then, combined with the other measures which we have outlined, it is bound to bring the person back to a normal healthy diet.

These will be sketched with a full realization that the average victim of the trouble under discussion has not the necessary will power to put so simple a régime into operation. We moderns often fail to realize how recently our race has developed a dependency upon sugar. A little more than six generations ago, those who wanted sugar went not to the grocery store but to the apothecary shop. It was kept as a flavoring material for children's food, as a welcome addition to the dietary of the aged, and invalids, and really as a drug for its slight diuretic qualities. In the days of our great-grandparents, a thousand tons of sugar sufficed for the whole world's needs, while the year before the great war, there was consumed 22,000,000 tons of sugar. It is estimated that the average consumption of sugar by every man, woman and child in the United States is a quarter of a pound. One result of this is that diabetes (a disease in which the mechanism by which the body utilizes sugar has broken down) is no longer a rare disease but a very common one. It has been estimated by an authority that there are over one-half million people in this country who either have diabetes or will have.

Another result is a great increase in constipation, for this is a very potent factor. The race for thousands of years has been getting its sugar by the personal manufacture of it from starch substances. It is very important for the constipated person to realize the dangers of the sugar habit. Sugar is quite as artificial a product as alcohol, and is capable of doing almost as much harm as its distantly-related chemical.

Lunch. If you are doing desk work, then the mid-day meal should be easily digested. Many people make this too heavy.

The best quick lunch for the average desk worker, who must hurry, is the bowl of milk or half-and-half, with shreaded wheat Trients or other whole-wheat products. Follow this by a few minutes of leisure in congenial company and you will be ready for work again.

If you require more food for lunch, see that it includes at least one vegetable other than potatoes, with some whole-wheat bread, or

other natural-grain crackers or biscuits, and fruit Except for rapidly-growing young people, meat and fish are generally needed only once a day

Supper or Dinner—The typical American dinner is the result of a long effort to adjust the available food supply to the needs of the body Consider the usual items and their food content

Soup	Water, salts, vegetables, meat juices, vitamins— little roughage, but a good digestive stimulant
Meat	Proteins and some fats, mineral salts, relatively little roughage and vitamins
Vegetables	Carbohydrates, vitamins, salts, and roughage Some protein and fat. All the food elements
Dessert	Carbohydrates and generally little else—but en- joyable and usually taken in excess
Cake, pie and pudding	Containing, between them, vitamins and all the various food elements
Fruits, nuts	

This dinner contains all the necessary food elements and usually two or three times the necessary quantity The use of soup is an excellent custom Soup stimulates the tired glands of digestion But some soups are better than others, the better, those which contain green vegetables or their extracts, the worse, those which are built up with white flour, spaghetti, macaroni The latter, however, may be the better for you if you are doing hard physical work and need food that generates energy

Dessert gives an opportunity to eat many kinds of fresh and stewed fruit A properly-baked apple pie, rhubarb pie, or raisin pie is a delight and may be very good food Puddings and pastries are, as a rule, poor food for those who sit at their work, although perfectly satisfactory for those who get plenty of outdoor exercise To give the meal its final touch, it is well to have on the table a dish of apples, raisins, figs

The priceless ingredient of the meal, however, is a spirit of happiness and cheer Pick up some interesting anecdotes, stories, or jokes during the day and tell them at dinner table Laughter is good exercise for constipation. It is the only exercise, other than the chewing, that should be taken during the meal

If you follow the suggestions concerning breakfast, lunch and dinner, you will overcome your constipation and live longer

In this connection it is surprising to discover how few people

are acquainted with the virtue, both from a financial and an economic point of view, of chopped raw cabbage. It is best for the constipated person not to chop it too fine or to masticate it very well. This food served as a salad with French dressing can be taken without the slightest discomfort or after-effects by patients who have never been able to eat cabbage prepared in the usual way. The Metropolitan Life's King Salad is a most happy combination. It is made as follows

Raw cabbage	Shred fine, soak in cold water, drain
Raw carrots	Scrape, wash, shred fine
Dressing	Salt, one half teaspoonful Lemon juice, two tablespoonfuls
	Olive oil, 4 tablespoonfuls Mix in the order given and beat vigorously

Take equal parts of the cabbage and the carrots (add shredded green peppers, onions, celery, cut across the stalk, sliced cucumbers if you wish). Rub a kernel of garlic on the inside of the mixing bowl.

Serve on lettuce with or without sliced tomatoes

You must get plenty of fluids every day. You should take two quarts of water at the very least as your twenty-four-hour portion. Thanks to the careful work of Professor Hawk, we know that fluids taken with the meal are not harmful *unless they are used to wash down unmasticated morsels of food*. Drink with your meals but take it after you swallow one bite, and before you take the next.

Tea, coffee, cocoa should be avoided. The constipating tannin can be neutralized by the additional quantity of cream. The objection to this practice is that you are adding concentrated food-stuff to your diet, which is bound therefore to crowd out bulkier and, therefore, more useful food.

In tea the tannin can be avoided to a great extent if it is made properly in the true Chinese fashion. In the first place, as a rule, Chinese tea contains less tannin than either India or Ceylon, and is therefore the more suitable. The longer tea is infused, the greater will be the proportion of tannin which it contains. You should follow the customs of the Chinese, therefore, and infuse the leaves for a few seconds only. Such tea can be taken by you if not used in excess of two or three times a day.

As regards milk, it is to be looked upon as a concentrated food and is not therefore to be taken in large quantities by the constipated

It increases the constipation of some persons and is an invaluable aid as long as it is taken once or twice a day by others. Buttermilk and other sour milks are usually laxative.

The two most potent factors in the production of all kinds of gastro-intestinal disturbances are fatigue and loss of sleep. It is important that you get a sufficient amount of rest. After you have placed yourself on this régime, then by trial determine how many hours you must get to awaken in the morning refreshed and ready for the day's work. If it be six hours, get it at a regular time in each twenty-four. If it is ten, then get it in the same way.

Before you retire do not forget to spend a few minutes at your exercise again. Form a habit in this regard.

For you there is a great truth in the old adage, an apple a day keeps the doctor away. An apple eaten at bedtime leaves a far better taste in the mouth than a glass of milk or a piece of bread and butter, and with many it takes the place of the pernicious cathartic pill. Besides, the apple juice is beneficial to the teeth.

The most common source of constipation is the use of drugs to obtain a daily stool. Laymen have copied the practice of giving a routine cathartic from the family physician without recognizing the indications for this procedure. So people frequently resort to the indiscriminate and senseless use of medicine in order to move the bowels. Persons confined to bed may at times need a cathartic to overcome the natural tendency to constipation brought on by recumbency. There are other special indications when drugs should be given to move the bowels but there is absolutely no place for the routine purge. The administration of a cathartic should be left to the judgment of the physician. If the principles of the régime outlined above are adhered to there will be no need of ever resorting to cathartics.

There are three preparations, however, which are not drugs, both of which are widely advertised under various trade names which deserve some discussion here as to their value and their limitations. In 1905, Adolf Schmidt introduced agar agar into the treatment of that form of constipation characterized by the passage of a scanty amount of fecal matter in the form of dry, hard lumps. This substance is the dried mucilaginous material extracted by hot water from certain Japanese algae. It is almost indigestible in the normal

human gastro-intestinal tract It does help in those cases of chronic constipation in which it is desirable to increase the bulk of feces It is particularly valuable because it does not produce gas

Liquid petrolatum U S P (mineral oil) is of value in softening the feces It is not digestible and remains in the feces in the form of globules It does not supply any oily film to the water-soaked gut wall as many seem to think. By softening the stool, it will aid in the healing of superficial lesions of the mucosa For this same reason it helps in those cases where there is intestinal stasis due to kinks or other forms of obstruction—even malignant tumors Here it can only help for the moment and often does harm because the patient on account of temporary relief puts off the day of his operation

Fancy-named products should be avoided as unnecessarily expensive and of no more service than the official liquid petrolatum

Psyllium is another harmless help to the needy It consists of the seeds of plantago psyllium It looks like bird seed, becomes slippery when moistened, and, like the seeds of figs, aids bowel movement It is not troublesome to take, since the seeds mix well with water or with honey, which was the laxative commonly used in the days of our great-grandmothers Psyllium is slightly stimulating, as well as lubricating A tablespoonful can be taken with each meal

CONCLUSION

To effect a cure without becoming a physical cultural faddist is quite possible Physical reeducation, however, is necessary When a small boy with a faulty posture is told to stand erect he will at once assume the posture at the other extreme and one equally as bad as the first habitual one Because he experiences different sensations, he now feels that he is standing properly So in your case you need a reeducation of the body muscles, especially of the abdominal and erector spine groups There is no occasion, however, for adopting excessive exercises Exercises should not become a mere end in itself Just enough exercise should be taken to get and keep the muscles of these important groups in good tone. One point to be remembered is that the need for exercise of these muscles often exists in people who do the hardest of manual labor or play the most

strenuous games A careful survey of both college women and of shop girls showed that the great majority wore flabby muscles here and there, and therefore that even the most robust were constipated and had difficulties of menstruation. You do need to follow the rules laid down as to exercise

Neither is there any reason why you should become a food faddist "All things in moderation" We have tried to set forth the few fundamental principles which should govern your diet It should be made up of the ordinary eatables so that you do not find the securing of foodstuffs troublesome or embarrassing It should be varied but it should be, other things being equal, composed of the bulkier food materials Agar agar will be of great service to you for the next few months in this respect There is one great danger and that is that by the selection of the bulkier things you satisfy your appetite before you have taken in food which will yield sufficient energy to carry on the day's work You may find yourself using a diet which is short in calories This would be unfortunate since it would delay your recovery by making the induction of fatigue so much the easier

In conclusion we may say that in the above pages we have outlined the method, daily régime, necessary for overcoming functional constipation It does not follow of course that because you have read that you will be cured. The final result and benefit to you depends upon you, and it means so complete a change of bodily habits and mental outlook that many patients fall by the wayside and are lost. If you are interested and respond, you will try the physical exercises, the diet and form the habit of going to the stool regularly It is assumed by many doctors of medicine and most patients that the desired result will be substantially attained. Such an assumption implies that the means or effective conditions of the realization of a restoration to health exist independently of established habits and even that they may be set in motion in opposition to habit It is assumed that the means for health are there, so that the failure to healthy normal bowel movement is wholly a matter of failure of purpose or desire Physicians often fail to remember that they do not—cannot—practice what they preach about certain health matters We all fail to appreciate the importance of objective conditions

Now in fact a patient who can have regular normal bowel move-

ments has them, and only one who can, does. So feats of will are either unnecessary or useless. Improper regulations of the bowel is just as forceful, just as positive a habit as the proper regulation. It is not a failure which can be made good by mere order of the will. It is as reasonable to expect a fire to go out when it is ordered to do so as to suppose that a man can regulate his bowels in consequence of a direct action of thought and desire. The fire can be put out only by changing objective conditions. It is the same with the reëducation of the physical self. The only way for you to discover for yourself and to perform this unaccustomed act is then by a "flank" movement. You must stop thinking of your bowels and their movement. To think of it is fatal, for it commits you to the operation of an established habit of improper regulation. You must find a positive interest or line of action which will inhibit the series of acts leading to constipation. The discovery of such a series is at once your means and your end. Until one takes intermediate acts seriously enough to treat them as ends, one wastes one's time in any effect at change of habit. Of the intermediate acts the most important is the next one. The procurement of health thus appears as a series of "what nexts," and the "what next" of chief importance is the one nearest the present state. So we have set forth for you a series of "what nexts" which effect for you the flank movement. This, if taken advantage of, will lead to the desired end—the normal regulation of the bowel movements and a sense of physical well being which is characteristic of GOOD HEALTH.

REFERENCES

This paper represents essentially a résumé of current thought on the subject of constipation and is based on practically all papers appearing in the medical journals printed in English since 1920.

The work of Dr. John Bryant, Dr. Arthur Hurst, Dr. John Kantor and Dr. Horace Soper have been freely drawn upon, as have the symposium published by the *New York Medical Journal* in March, 1914, and the helpful booklet of the Metropolitan Life Insurance Company.

THE TREATMENT OF VARICOSITIES OF THE LOWER EXTREMITIES *

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BY WAY of introduction I wish to say that when your President invited me to address you, and informed me that I was to speak before a body of men made up largely of progressive general practitioners, I concluded that no subject would offer more excellent opportunity for discussion than the care and treatment of varicosities of the veins of the lower extremities

Varicosity of the veins may be defined as a permanent dilation of the vein, associated with the destruction of the valvular mechanism. It is rarely seen elsewhere than in the lower extremities, and is almost exclusively confined to the superficial veins, namely the external and especially the internal saphenous veins. Because of the powerful support afforded by the contiguous and overlying muscles and aponeurosis, the deeper veins are less likely to become over-distended and varicose. The saphenous vein is largely dependent upon its fifteen or more bicuspid valves distributed throughout its contour for overcoming gravity in interfering with the return flow of blood to the heart.

Etiology — Varicose veins of the lower extremities appear most frequently in the second or third decade of life, although cases are recorded which developed before adolescence, while we all have observed instances of this condition in those of advanced age

Several writers have suggested that the congenital condition of the venous system is a strong predisposing factor in bringing about the dilatation of the vein and incompetency of its valves. Straining, particularly for prolonged periods of time in the erect position,

* Read by invitation before the Progressive Medical Society at the stated meeting held at Hotel McAlpin, Tuesday, November 13, 1928

is mentioned as a presumptive cause of the frequency of this condition among cooks, waiters, and artisans who occupy an erect position during the greater part of their work

Phlebitis following typhoid and sclerosis of the vein incident to advancing age are also sources of permanent injury to the valves, followed by gradual dilatation of the vein

Varicosities appearing during the period of pregnancy are not caused by the pressure of the enlarged uterus, as was supposed, but is now recognized as a condition very frequently associated with endocrine disturbance incident to the pregnancy, and usually responds to appropriate glandular treatment

The changes observed in the vein that has become varicose are the inefficiency and uselessness of its valves, brought about by the gradual dilatation of its lumen. The muscle fibres and elastic tissue in its walls are converted into scar tissue which stretches irregularly, the vein becomes widened and lengthened, causing it to become tortuous and sacculated, and occasionally areas of calcification are observed.

In thrombo-phlebitis of the saphenous vein we find the walls thickened and the elastic tissue may be quite abundant. The dilatation may be very slight but the valves are destroyed. The vessel may feel like a hard cord underneath the skin. When the perforating veins are involved, they are frequently the source of areas of malnutrition, which leads to the formation of the troublesome varicose ulcer. In the early stages, before ulceration takes place, these areas of malnutrition are manifested by areas of discoloration, especially on the anterior and inner aspects of the leg. Trauma and infection in poorly nourished, chronically congested tissue predispose to the development of varicose ulcers.

Clinical Manifestations —The skin feels tense, itches or burns. The leg feels stiff and heavy and tires after walking or standing for any length of time. The discomfort is all the more intensified with the development of ulcer. Atrophy and pigmentation of the skin, œdema and malnutrition are due to a local venous stagnation.

The purpose of this paper is to bring before you for consideration and discussion some of the more recent methods employed in the treatment of varicosities of the lower extremities.

Aside from the discomfort, pain and complications such as

eczema and other trophic conditions varying from discoloration to that of breaking down of the tissues, especially in the lower third of the leg which may lead to troublesome ulceration, the unsightliness caused by these tortuous bluish prominences along the course of the external and especially the internal saphenous vein affords the woman in particular, considerable cause of anxiety. This is especially emphasized today because of the transparent hosiery which is now in vogue. And it must be of even greater concern to those who believe that the stockingless fashion has come to stay. Be that as it may, the number of applicants, particularly women, who come for treatment for varicosities of the lower extremities has increased manifold within recent years.

It may be seen from the foregoing that the former conservative or palliative measures, particularly the elastic stocking, Murphy boot and various other types of supportive bandages have lost in a great measure their importance, because of the short skirt and translucent stockings.

Necessity is the mother of invention, and accordingly new and improved methods that would do away with much of the impracticability of operation have been sought for and have had their trial. Among these is the obliteration of the vessel by the intravenous injections of corrosive substances which is followed by obliteration of the lumen and a sclerosing or atrophy of the vessel.

History of Surgical Procedure—The method of treatment for permanent relief of a dilated condition of the saphenous vein has in the past been surgical intervention. It had its beginning in the *modus operandi* suggested and applied by Trendelenburg and his followers. His method consisted in several ligations of the long saphenous vein, starting preferably, with a ligation of the vein just above the ankle, this being followed by a second ligation above or below the knee, and a third, just below its termination into the femoral vein.

Because of the many instances of unsatisfactory permanent results attending this procedure, bolder attacks upon the superficial veins were subsequently undertaken by various operators. Among the methods suggested and practiced was the extensive varicotomy of Schede, which still bears his name. This procedure was in turn improved by Naraeth, Madelburg, Casati, and the technic revised

by the Mayos, Babcock and others. These mentioned methods are today recognized as the technic par excellence for the removal of the varicosities by radical surgical measures. These means, however, more or less satisfactory as to results, require hospitalization of the patient for a period of two weeks or more for post-operative care and observation, thus entailing partial or complete disability of the individual for a definite or prolonged period of time.

Development of Intravenous Application.—As a result of more recent observation, it has become evident that varicose veins of the lower extremities are a much more common affliction than most of us had formerly believed. This inference has very logically been based upon the extraordinarily large increase in the number of applicants for the treatment of varicose veins since a satisfactory ambulatory method of therapy has been devised. Obviation of the various discomforts attendant upon the operation is undoubtedly responsible for the greater demand for relief from this apparently common complaint.

The old adage, "There is nothing new under the sun," is well illustrated in this connection. As long ago as 1851, Pravaz, who had perfected a syringe (known as the Pravaz syringe), sought a method of producing occlusion, or thrombosis, in blood vessels, by chemical means, and with this end in view injected solutions of perchloride of iron. Medical literature does not disclose many followers of his method of procedure.

In 1911, Professor P. Linser, of Tübingen, Germany, observed that obliteration of veins followed repeated intravenous injection of mercuric chloride in the treatment of syphilis. Concluding that this method of treatment might readily be applied for the obliteration of varicosities of veins already diseased, he continued to employ this substance, for this definite purpose, until 1923, at which time he substituted a 20 per cent sodium chloride solution, believing the latter to be more safe.

Meanwhile, other European investigators had focused their attention upon this new means of therapy in connection with varicosity of the veins—a method which from the outset seemed to prove thoroughly efficacious and satisfactory in its immediate as well as in its permanent results to the physician as well as to the patient.

Prominent among the pioneers in this field of work is the name

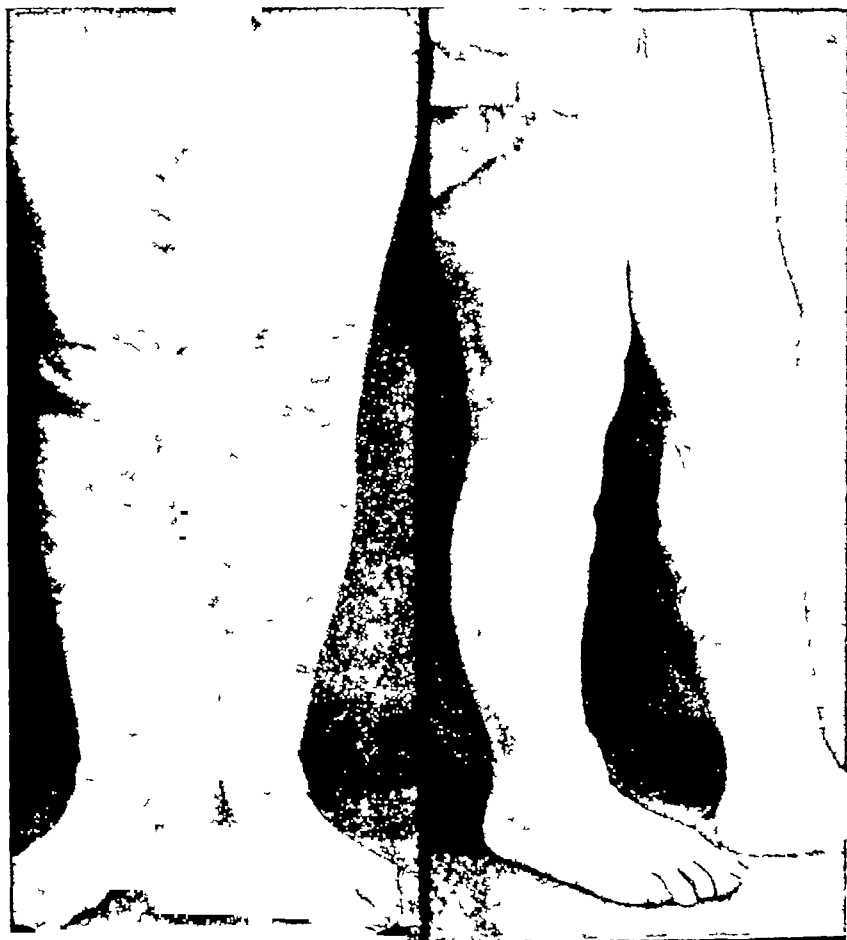
of Professor Sicard, of the Neckar Hospital, Paris In 1917, while treating a large number of soldiers with luargol—a preparation of sodium and arsenic—he likewise noted instances of thrombosis of the veins of the arm following the intravenous administration of this drug Believing that the sodium contained in the preparation was responsible for the thrombosis, he thereupon experimented with sodium carbonate solution While fairly encouraging results were thus obtained, there was present an objectionable feature, namely, necrosis of the surrounding subcutaneous tissues, due to leakage of the solution This annoyance, however, was subsequently obviated when Sicard, in conjunction with his associates, Parof and Forestier, hit upon the use of salicylate of sodium, the injection of which solution was attended with much more gratifying results

Following this, numerous other investigators reported favorable effects as a result of intravenous injection of different solutions, some made use of single chemical products, while others created various combinations Among these are included the following Biniodide of mercury, solution instituted by Montpellier and Lacroix, quinine and urethan, employed by Genevrier and Dowthwaite, and glucose, used extensively by Nobl and others, while Schussler employed metaphen in a solution of 1–500 in several hundred cases Among the other substances which have been injected in the treatment of varicose veins are Lugol's solution, containing 1 per cent of iodine and 1 per cent of iodide of potash, sodium citrate, mercuric chloride, alcohol, and the so-called *Invertzucker* solution—also known as calorose—containing from 4 to 6 per cent cane sugar combined with dextrose and levulose

As with other medical or surgical procedures which appear to have sufficient merit for extensive application, the injection method for the treatment of varicosities of the veins not only has gathered many advocates but numerous methods of procedure These will be referred to later in the course of this discussion

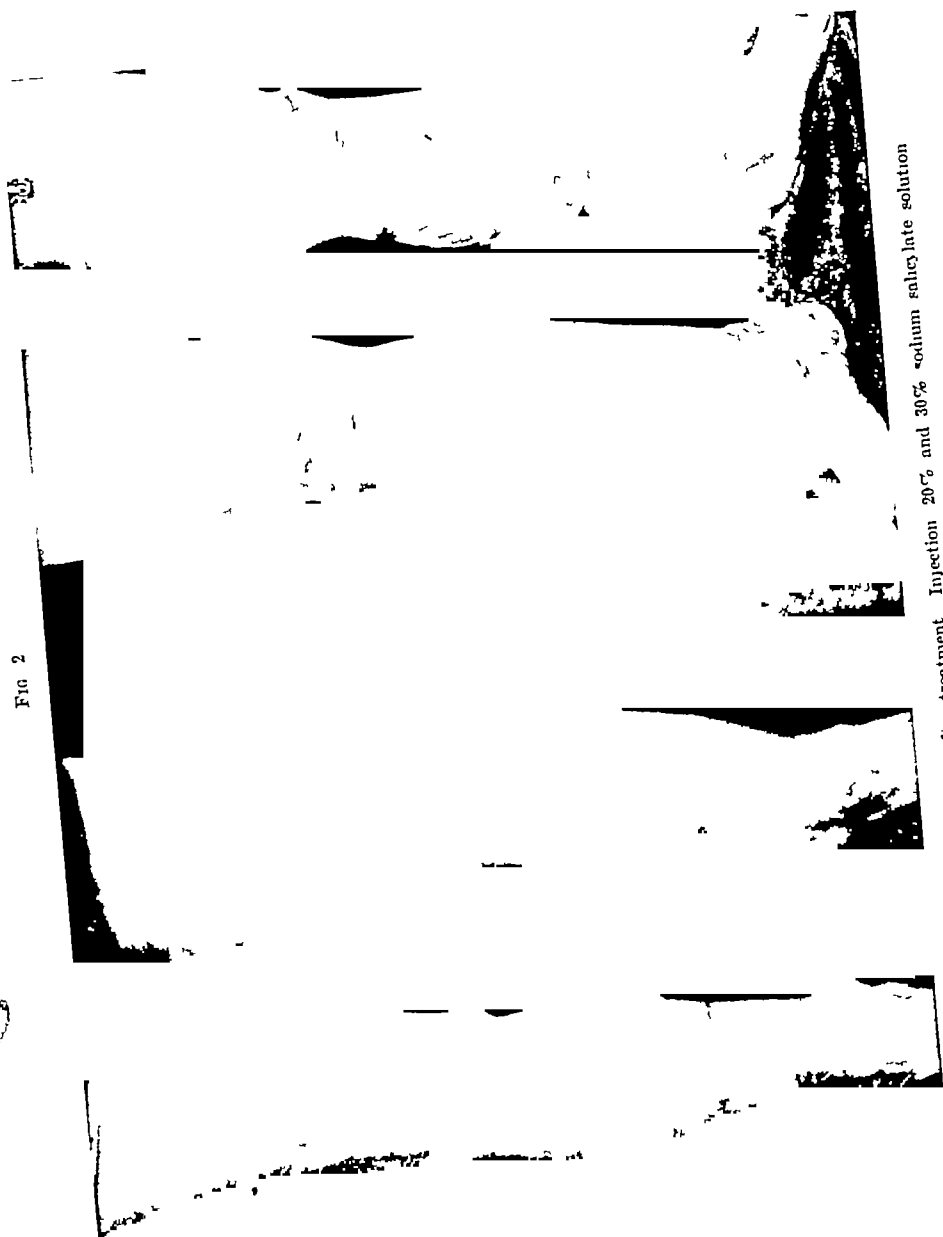
When a new or apparently new method of treatment is presented, the main questions which arise for primary consideration are the following *First*, does the treatment advocated prove safe in its application? *Second*, does the method offer results satisfactory to the patient and physician in the majority of instances? From my

FIG. 1



Varicose veins of the lower extremities before treatment (S D female age 52 years)

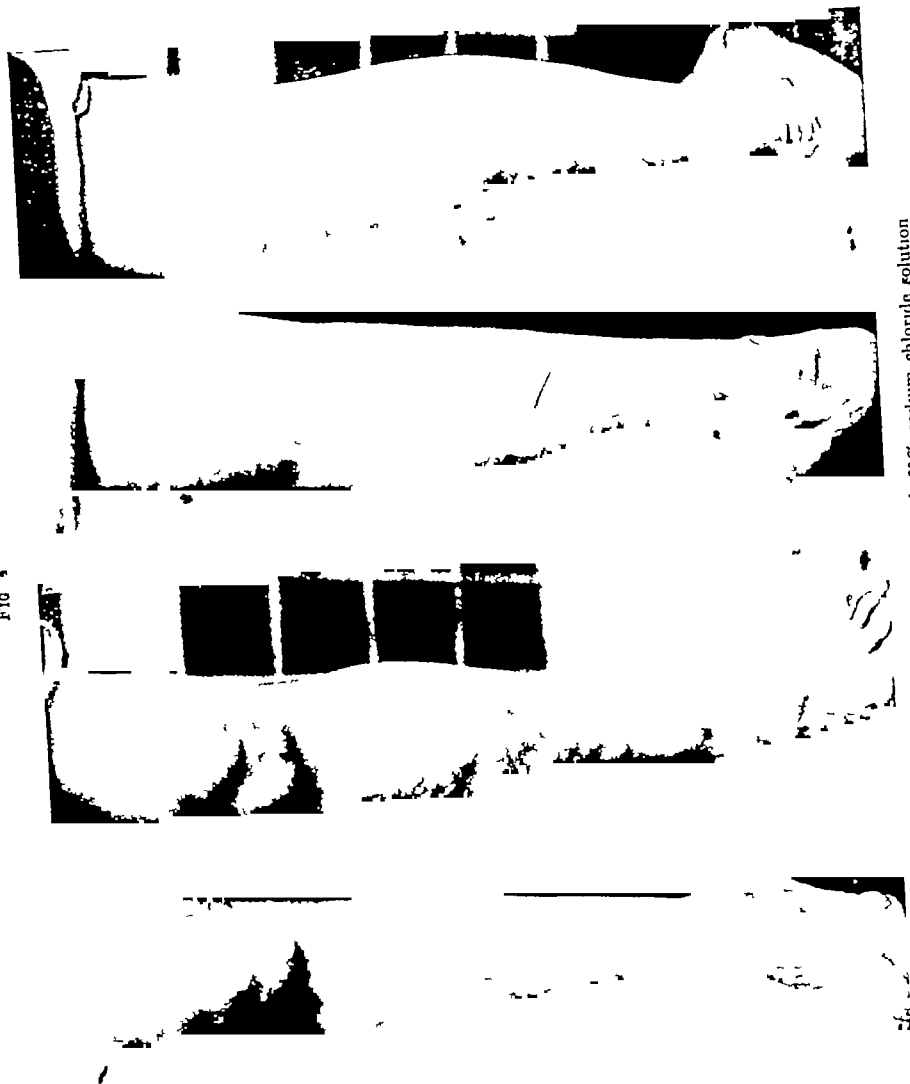
FIG 2



Same patient as shown in Fig 1 after treatment

Injection 20% and 30% sodium salicylate solution

FIG. 4



Same patient as seen in Fig. 3 after treatment with 20% sodium chloride solution

Varicose veins of the lower extremities before treatment (B K male adult)

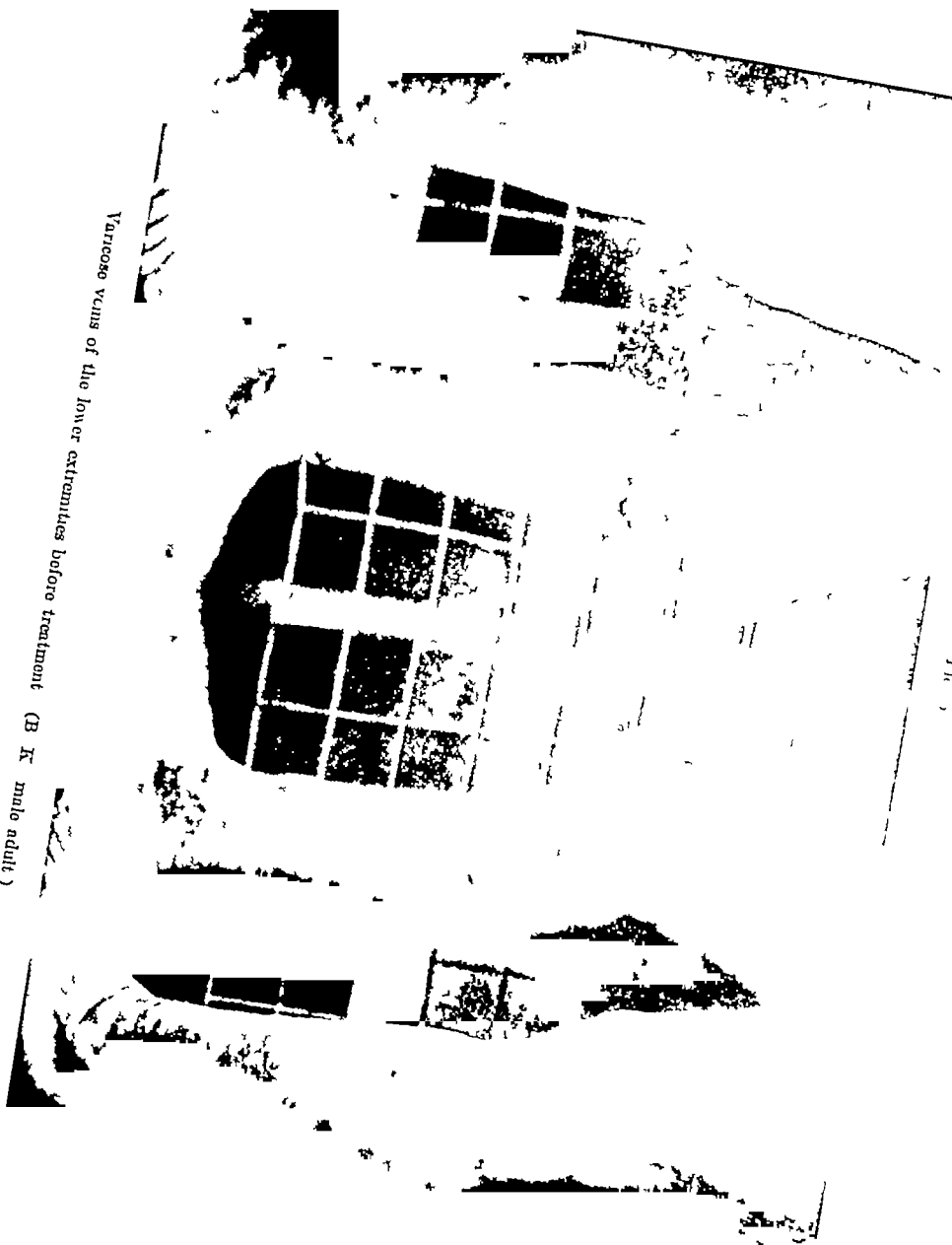
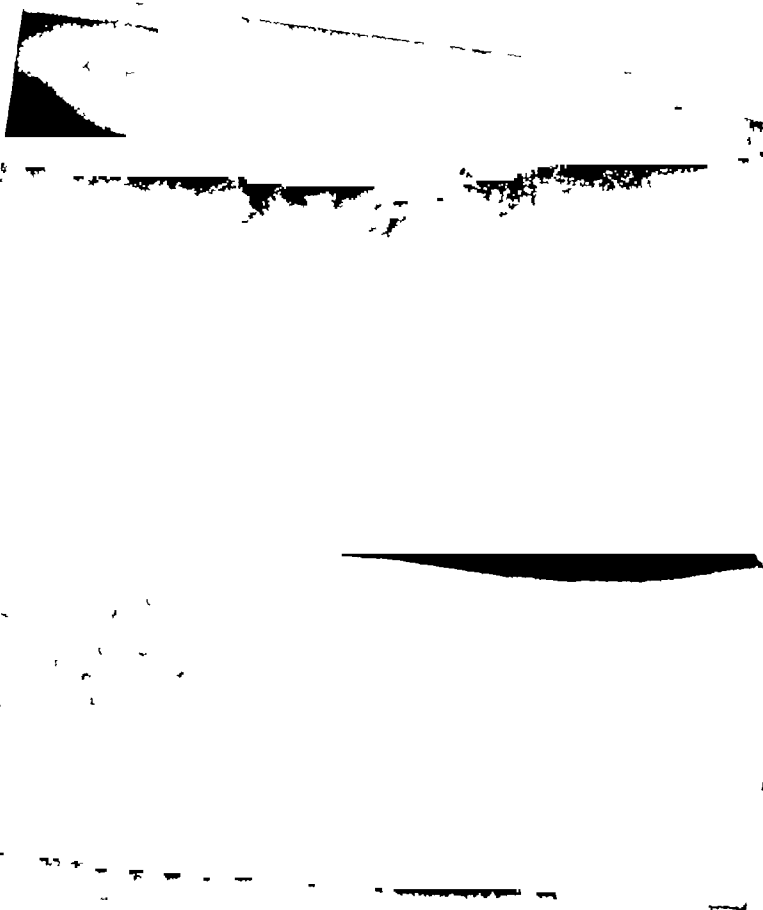


FIG. 6



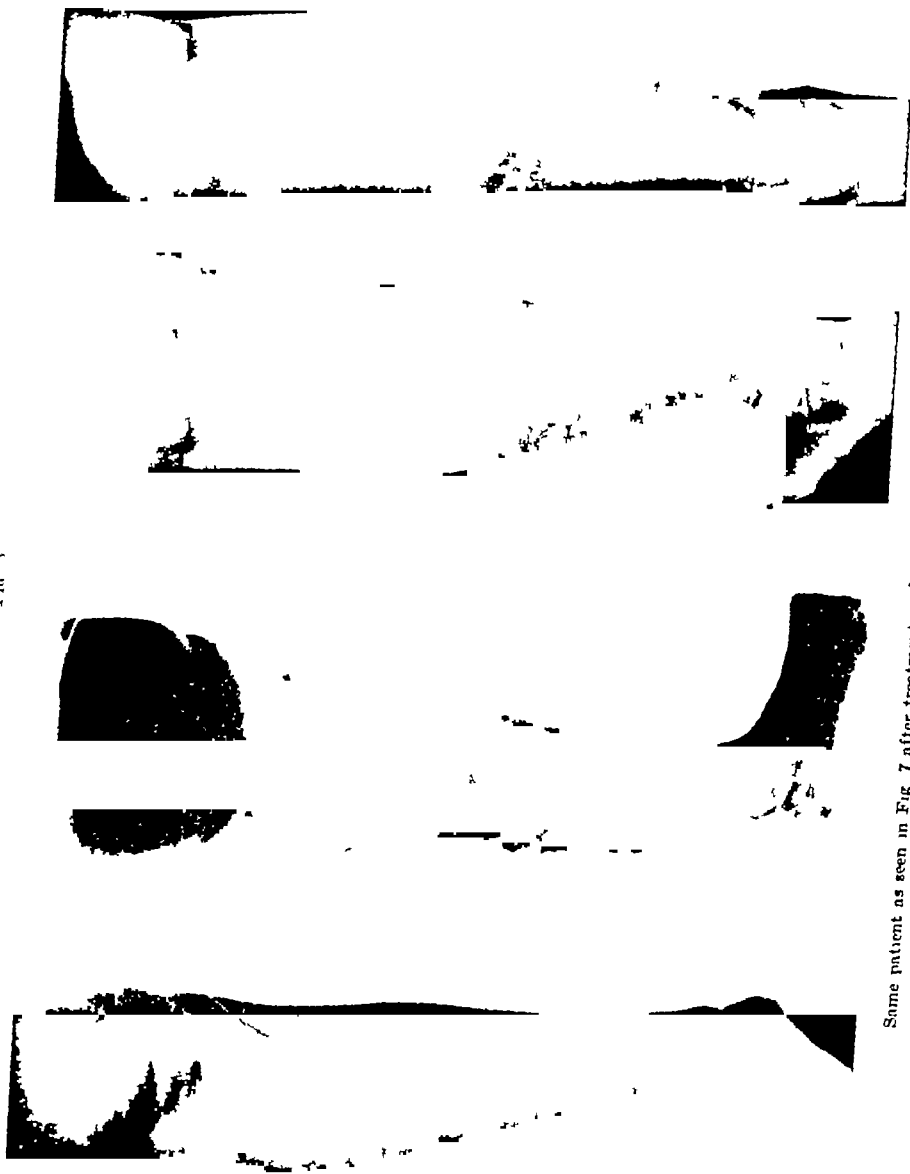
Same patient as seen in Fig. 5 after treatment. Injection of solution sodium chloride in 20% strength

Fig 7



Varicose veins of the lower extremities before treatment (J G female aged 41 years)

Fig 8



Same patient as seen in Fig 7 after treatment with 20% injection of sodium chloride solution

FIG. 9



A

B

Male. J B Before treatment
(A)
After injection of a 30% sodium
salicylate solution (B)

FIG. 1



A

B

A I Female before treatment of varicose vein by the
injection method (A)
After injection of a 30% solution of sodium salicylate
(B)

own personal experience and from the literature at hand, covering a period of a comparatively few years and embracing a collection of 55,000 or more cases reported, results have been so satisfactory and the number of fatalities so infinitesimally small as to warrant the conclusion that the intravenous injection method has become an accepted mode of therapy in properly selected cases

Contra-Indications for Injection Method—Thrombophlebitis accompanying or subsequent to a recent affection such as typhoid, while presenting many similar clinical manifestations, due to the incompetency of the valves of the vein, is not favorable for the application of the treatment emphasized in this paper

The presence of phlebitis is a positive contra-indication This applies also to *phlegmasia alba dolans* As a positive Trendelenburg test would indicate that there is an involvement of the deeper veins and there is danger of fatal embolism following intravenous injection, it must be applied with great caution, if at all, in these patients In the presence of œdema, of advanced cardiac disease, nephritis and diabetes, this method should likewise not be employed, neither is it applicable in old or debilitated persons It has no place of application in congenital varix

Varicose veins in the course of pregnancy should not be injected In the large majority of instances the condition is transitory The veins are restored during this period or shortly thereafter, particularly if the underlying endocrine disturbance is remedied by the administration of appropriate doses of thyroid, pituitary, and ovary, respectively, or in combination, as may be indicated

Diabetes is a contra-indication because of the danger of inciting gangrene Injections should not be made during the menstrual period because of the greater reaction observed following treatments at this time In angio-thrombophlebitis injection may also incite the development of gangrene and it is therefore contra-indicated in the presence of this disease

On the other hand, all other cases of dilated saphenous veins without the presence of phlebitis lend themselves readily to this form of treatment even when complicated by manifestations of trophic disturbance, such as pigmentation of the overlying skin, eczema and ulceration Higgins, in a recent enthusiastic résumé

of the subject, in addition to a review of his own experiences, reports general relief and a cessation of bleeding in several cases in which, previous to injection, alarming hæmorrhages had occurred from rupture of superficial thin-walled varices

Histological Process Induced by Injection.—The purpose of the injection is to create a rapid destruction of the endothelial lining of the vessel. Observations made by various authors have shown that the injections of certain substances into the veins of animals were immediately followed by destruction of the endothelium, with collapse of the segment of the vein involved

In carrying out this process of destruction, the primary action of the sclerosing substance is directed toward causing the endothelium to become rapidly swollen. At the same time contraction of the muscularis takes place, occluding all or nearly all of the lumen of the vessel. The remaining lumen, if any, rapidly fills up with blood clot, which has a tendency to organize and remain firmly attached to the underlying wall of the vein. It is this characteristic tenacity with which the clot remains firmly attached to the underlying structure which renders the injection method safe from the dangers of embolism

Régard, in presenting a description of this pathological process, recognizes three distinct stages, *First*, the irritant produces prompt swelling of the endothelium which rapidly extends to the other coats of the vein. The result is a thickening and hardening of the wall and a great reduction in the lumen. The lumen becomes further constricted until blood flow practically ceases. *Second*, thrombosis takes place in the remaining minute lumen of the vessel. *Third*, the vein becomes organized into a solid fibrous cord, the last being designated by Sicard as a "venitis," beginning as an "endo-venitis," thereby differentiating it from a "phlebitis" in the generally accepted sense of the term. Sicard found the process to be self-limited, non-infective, non-febrile, and never associated with the formation of loose clots or the risk of emboli

To determine the course of the solutions thus injected, Jentzer of Geneva observed by fluoroscopy, that a 20 per cent bromide solution could be observed to travel *against* rather than *with* the blood current, and that it did not reach the deeper veins. Sicard and Gangier, also Forestier, made similar observations after injecting iodized oil into the vein. The solution of high specific gravity

rarely reaches a higher level, if any, than the point of injection and is retained in the stagnated blood stream of the diseased vein

According to these authors, the changes which occur in the vessel following the injection of corrosive solutions are described by them as follows. An abrasion of the endothelium, an anatomic alteration brought about by the caustic injection which is, at first, irritation of the endothelium and congestion and proliferation. In the secondary stage, fibrin is deposited over the injured endothelium, following which, as the third and last stage, sclerosis sets in, with atrophy of the entire vessel.

The injection is usually followed by a transitory phenomenon of discomfort, due to the excessive intensity of the chemical reaction.

Solutions Employed for Intravenous Injection.—A number of the substances which have been and are at the present being employed for this purpose have already been referred to above in recounting the evolution of this non-operative procedure.

Since the intravenous injection method has been adopted for the treatment of varicosities of the veins, the solutions employed have varied somewhat with different operators. However, sodium chloride in solutions of 18 and 28 per cent and sodium salicylate in dilutions of 20, 30 and 40 per cent, have been used more extensively than any of the others.

Recently glucose has also been introduced and employed with gratifying results by Remenowsky and Kantor, who claim for this solution a reaction that is more gradual, more marked, and the final results permanent. They emphasize, further, that glucose is less irritating to the subcutaneous tissues in cases of leakage.

Professor G. Nobl, on the other hand, has advocated the use of an Invertzucker solution, suggested by Kausch, and known as calorse. This solution consists of 73 to 75 per cent. Invertzucker with 4 to 6 per cent cane sugar, equal quantities of dextrose and levulose, and water. Nobl reports most favorable results with 3500 cases.

Mosczkowiez advocates the addition to the solution of adrenalin and uses as large a quantity as forty cubic centimetres of the fluid during one treatment.

Although the employment of quinine hydrochloride and urethan has been enthusiastically recommended by Genevrier, the objection to this substance is raised that it may be followed at times by violent necrosis of the tissues.

Bimiodide of mercury, employed by Sicard in his earlier cases, has now been discarded, because it has been clearly demonstrated that some patients have an idiosyncrasy for mercurial salt. Intravenous injections of this solution may be followed by violent symptoms of mercuric poisoning, which may lead to the death of the patient. An example of this type was a case reported by Hammer in 1919, who attributed a fatality to this cause, in spite of the fact that he employed the standard dose advocated by Linser. McPheeters and Rice believe that a great danger lies in the fact that the borderline between the therapeutic and the toxic dose is very small. They are of the opinion that mercury should seldom be employed, and under no circumstances unless one is assured of perfect kidney function. They refer to numerous reports in the literature of toxic symptoms following its use and of having, on several occasions, personally observed an acute nephritis which persisted for several days.

We have used largely a solution of sodium chloride, 20 per cent, and in a few instances a 28 per cent solution was employed, where the veins were unusually large and where it was felt that a weaker solution would not be sufficiently concentrated in the large column of blood to produce an abrasion of the intima.

Sodium salicylate has afforded us results just as satisfactory as sodium chloride but, at the Hospital for Joint Diseases, where a very large number of patients are treated several times a week under the supervision of Doctor Tunick, the use of sodium salicylate has been limited to the injection of smaller varicosities.

Sodium carbonate and other sodium salts, aside from sodium chloride and sodium salicylate, have now practically been abandoned because of the decided advantages of the latter.

Iodine in solution, as well as iodide of potash, have had but one or two advocates. The use of these solutions has been limited to a comparatively few number of cases reported thus far.

Technic—Before attempting a description of the technic of the intravenous injection—a procedure which in trained hands is a comparatively simple one—it is important to emphasize the fact that when not properly carried out it may be followed by unpleasant complications and symptoms. It is especially relevant because several unfavorable results, in improperly selected cases, have been reported in the literature.

Before applying this therapy the applicant should be subjected to a complete and thorough physical examination. This examination should precede the treatment irrespective of the solution to be employed. An examination should also be made of the urine for the presence of albumin and glucose, and an examination of the dorsalis pedis and posterior tibial arteries. Evidence of thrombosis of the dorsalis pedis or posterior tibial artery renders the case unsuitable for the injection treatment. The presence of an advanced cardiac or renal disease is an absolute contra-indication for the intravenous method of treatment. The presence of glycosuria or symptoms suggestive of diabetes must also be considered as unfavorable.

While some of the operators favor the reclining posture for the administration of the injection, the patient in the upright position offers the distinct advantage of bringing the varicose vein to be injected into bold relief. The patient should be standing, rendering the veins prominent. A couch is provided so that the patient may lie down for a while after the injection. The injection is usually followed by sharp, cramp-like pain, lasting one or two minutes, due to the spasm of the vein injected. This must be differentiated from the burning pain following an accidental injection into perivascular tissue. It is well to have a sturdy chair for the patient to grasp during this paroxysmal pain. No tourniquet is employed. The injections should be begun in the lower part of the limb, in the following manner. A moderate-sized needle attached to a glass syringe is introduced into the vein to be injected. The appearance of blood in the syringe would indicate that the needle is in the lumen. After the injection is made, at least twenty seconds should elapse before the needle is withdrawn. After the needle is withdrawn, pressure is immediately applied by a compress of gauze, which is held in place by a few turns of bandage. If the needle has not penetrated the lumen of the vein, a burning or pricking pain will be experienced by the patient.

Immediately after the injection, previously tortuous veins will straighten out and, upon palpation, will feel like a hard cord. This induration may take several weeks to subside.

All of the solutions thus far advocated are more or less irritating to the subcutaneous tissues. An escape of the solution by leakage alongside the needle, or as a result of faulty technic in penetrating

the lumen of the vessel, may be followed by localized necrosis which is troublesome to heal. This danger can be reduced to a minimum if a needle is used of small calibre, say twenty-two or twenty-four gauge—one with a short and sharp bevelled edge is preferable. As the nose of the needle enters the lumen of the vessel, a current of blood will be forced into the syringe. This will assure the operator, as in any other intravenous procedure, that he has reached the lumen of the vessel. A very little pressure will cause the solution to enter the lumen without resistance.

Because of the fear of embolus formation, Streissler, Lotheisen, Schanz and Mosezkowicz and others have advocated the ligation and division of the saphenous vein below its outlet into the femoral, as a preliminary measure, before the injection of the sclerosing fluid is made. This part of the procedure constitutes, in reality, a Trendelenburg operation. Unger ligates the vein and then introduces a ureteral catheter into the distal end and makes the injection of sodium chloride solution.

Statistics gathered from the various clinics seem to indicate that the mortality from embolus following ligation of the saphenous vein alone is from one-quarter to 1 per cent, while from the literature gathered up to date by McPheeters and Rice, only seven deaths have been collected among 53,000 cases of the injection method reported, or a mortality of 0.0024.

It would seem from the foregoing, therefore, that we may conclude the preliminary ligation of the vein adds a decided danger rather than a safeguard for the patient. And therefore this measure should not be seriously considered as part of the procedure.

Treatment of Ulcers—The most disagreeable and painful complication of varicose veins of the leg is the varicose ulcer, so frequently recalcitrant to the usual forms of treatment. From observations made thus far we must conclude that the chemical treatment of diseased veins in the vicinity of the ulcer offers a most satisfactory means of healing, and the cicatrization takes place with extraordinary rapidity.

Forestier's injection of the solution into the vein at the site of the ulcer has been advocated, but the injection of a vein some distance from the ulcerated area affords very satisfactory results. It therefore appears unnecessary to risk the added danger of infection through the ulcer-bearing area.

Complications—The fear of embolus is comparatively negligible provided the precautions mentioned are properly observed

Necrosis, as already mentioned, can be avoided by proper technic in the introduction of a needle of sufficient calibre to permit the fluid to pass through it without resistance. It must not be too large to render possible immediate and spontaneous closure of the wound in the vein

The disagreeable results following the perivascular infiltration and leakage may be minimized by the immediate injection of a physiological salt solution into and about the infiltrated area. This has been suggested by several authors as a means of diluting the corrosive solution, thereby diminishing the danger of tissue destruction

Recurrences—Between 10 and 15 per cent of the cases injected show evidences of recurrence. A re-injection of these areas with a solution of somewhat higher concentration will usually be followed by satisfactory results. Forestier noted that recurrences occur, not on the obliterated varices, but in new varices appearing after injection. He points to the fact that, as the varicose condition is a diathesis, recurrences are not surprising. In such instances he suggests that a few supplementary injections, after one or two years, will no doubt be attended with favorable results

Conclusions—The injection treatment of varicose veins has passed the experimental stage and has been proved to be a very rational form of treatment. At least a thousand patients have been treated by the injection method in my own private practice and in the hospitals with which the writer is affiliated, and this without a death

The danger is small and the number of deaths following the injection treatment is very much less than that following operation. Only seven deaths directly ascribed to the injection have been reported in a series of 53,000 cases collected, in the paper by McPheeters and Rice, published October 13, 1928, in the *Journal of the American Medical Association*.

The injection of properly-selected solutions into varicose veins produces obliteration and secondary atrophy of the vein. The treatment is an ambulatory one. It is indicated in varices of the lower extremity either with or without the presence of ulceration

Disability during the course of treatment is practically unknown

The treatment does not confine the patient to bed and causes if any only a slight painful reaction

In the majority of cases results are entirely favorable, even very pronounced cases being cured within three to five weeks

Four of the fatal cases collected from the literature, as reported by McPheeters and Rice, are as follows

"CASE 1—This was one of our own series [McPheeters and Rice] prematurely reported and without our knowledge Mrs E C, aged thirty one, admitted to the hospital, June 3, 1927, had extensive varicose veins over both legs, from the lower thigh to the ankle, for the past six years She developed these during her first confinement. She complained of the legs tiring quickly and aching much on walking, in addition to their appearance The past history was essentially negative other than for a gonorrœal pelvic infection during the year previous to her admission to the clinic June 3, five injections of 10 cubic centimetres each of 25 per cent sodium chloride were made into scattered loops of the varices of the right leg Four injections of 10 cubic centimetres each of 50 per cent. invert sugar solution were given in scattered varicose loops in the left leg The patient reported again for examination June 5, at which time the normal reaction was present June 8 the patient was discharged with a perfect result, all the veins firmly thrombosed Those veins injected with invert sugar solution were not as firm as those injected with salt June 13 the patient suddenly dropped dead at 5 P M while walking about her yard at home The post mortem examination revealed the orifice of the pulmonary artery completely plugged with a large thrombus about two inches long This was very soft and resembled a recently formed clot The pathologist making the examination at first thought it was merely a post mortem clot, but microscopic examination revealed it to be a very recent thrombus of less than twenty four hours' duration in comparison to the well formed thrombi of ten days' duration found in the injected veins The rest of the heart was apparently normal Examination of the injected varicose veins of the lower legs showed the typical normal reaction following the injection and the presence of firm thrombi in the veins Aside from these observations, the post-mortem examination was essentially negative"

This patient was treated according to the method of Prof K Linser In a recent letter he states that he has never observed an embolus in his series of approximately 15,000 cases McPheeters and Rice accept this embolus as secondary and probably a direct extension from the thrombi produced in the varicose veins by their injection

"CASE 2—Hohlbaum reports a case in which 60 cubic centimetres of Pregl's solution was injected into one large varicose loop of vein at the level of the knee On the fifth day the thrombosis had advanced as far as the groin. On the fourteenth day the patient died with a typical clinical picture of a pulmonary embolus The autopsy revealed a large embolus projecting from the right ventricle, completely occluding the pulmonary artery, and a second embolus extending from the right auricle into the superior vena cava The saphenous vein was empty to the middle of the right thigh, where the embolus apparently originated."

Pregl's solution comes under the group of coagulating solutions and McPheeters and Rice believe that it should not be used. Injury and stimulation of the vein wall is the thing to be desired and not coagulation of the blood.

"CASE 3—As reported by McPheeters and Rice. This patient was also one of their series and was cared for at the outpatient department of the Minneapolis General Hospital. Mrs. H. S. had extensive varicose veins over both lower extremities, extending from the mid thigh to the ankles. This condition was present for thirty years. She was first treated, March 2, 1928, according to a new technic with 20 per cent sodium chloride solution. A "blanched ecchymotic patch" appeared at the site of injection in the left thigh. Forty cubic centimetres of sterile water was infiltrated into this area in an attempt to neutralize the excess sodium chloride. March 9 a dry gangrenous area about two inches in diameter was present in the left thigh at the site of the extravasated sodium chloride. All the veins were firmly thrombosed. Under procaine anaesthesia this gangrenous area was excised, the skin was undercut, and the edges were approximated with dermal sutures and adhesive strips. The patient was then seen every other day, and the excised area appeared to be healing. March 19 there was considerable purulent discharge. The sutures were removed and the wound was packed with iodoform gauze. March 20 the patient was admitted to the Minneapolis General Hospital. She was very restless and complained of a great deal of pain through the left leg and thigh. Hot packs were applied continuously over the entire lower extremity. The temperature was 104.5, the pulse 108 and the blood pressure 95 systolic and 50 diastolic. March 23 her condition was critical. The patient had pain in the chest. There was phlegmonous expectorate but no blood. There was occasional emesis. The temperature fluctuated in a manner similar to septicæmia. March 26 a blood culture demonstrated non hemolytic streptococci. Thirty-five cubic centimetres of 1 per cent. gentian violet was injected intravenously with 500 cubic centimetres of physiologic solution of sodium chloride. Improvement after this was temporary. The local condition in the leg had improved but the septicæmia could not be checked and she died March 31. Post mortem examination was not permitted but the death was definitely attributed to the septicæmia."

This case clearly demonstrates the importance of being always on the alert for infection. Surgery requiring complete excision and undercutting of the skin should not be attempted in the dispensary, where infectious patients are always present. These things should be done in the operating room, where complete closure of the wound can be made without drainage. It is our firm conviction that the infection in this case was introduced by ourselves at the time of the operative removal of the slough. On the assumption that this is true, surgery and not the injection treatment of varicose veins should be charged with this fatality. A slough of the tissue following the perivascular leakage of the salt solution is preventable with proper technic.

"CASE 4—Eiselsberg's patient had been treated with a concentrated sugar solution one month previously. He had a partially thrombosed knot of varicose vein which apparently was very superficial and had sloughed following the injection. The varix was open and bleeding as is often the case with very superficial veins. He excised the knot and ligated the saphena. The patient died of pulmonary embolism on leaving her bed ten days later."

We agree with McPheeters and Rice that this fatality should not be attributed to the injection, since the wrong treatment was used for the bleeding varix. In this case there was, in all probability, an infection present. Any operative work is contra-indicated in the presence of a phlebitis even though it is not extensive. McPheeters and Rice believe that this condition should simply have the dry gangrenous scab removed and the veins then packed daily with a small iodoform strip for drainage. They have seen a similar condition respond with perfect results.

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CUMULATIVE INDEX

(THIRTY-EIGHTH SERIES—1928)

(Where Roman figures are used i refers to Volume I (March) ii, to Volume II (June) iii, to Volume III (September), and IV, to the present December issue. The Arabic figures denote the page in which the reference will be found)

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